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SELECTED WATER RESOURCES ABSTRACTS

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VOLUME 16, NUMBER 9
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As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

PREFACE

Selected Water Resources Abstracts, a monthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. These documents cover water resources as treated in the life, physical, and social sciences and the related engineering and legal aspects of the characteristics, supply condition, conservation, control, use, or management of water resources. Each abstract includes a full bibliographic citation and a set of descriptors which are listed in the **Water Resources Thesaurus.** The abstract entries are classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the then Federal Council for Science and Technology.

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Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific
Information Center
U.S. Geological Survey, MS 421
Reston, VA 22092

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W83-02927

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W83-02993

FLOW DURATION CURVES IN TROPICAL EQUATORIAL REGIONS,
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W83-03018

CONTEMPORARY STOCHASTIC APPROACH TO WATER RESOURCE SYSTEMS: THE ARMP AND FEATURE PREDICTION MODELS,
State Univ. of New York at Buffalo. Dept. of Civil Engineering.
O. Ibidapo-Obe.
Advances in Water Resources, Vol 5, No 4, p 236-239, December, 1982. 1 Fig, 1 Tab, 8 Ref.

Descriptors: *Stochastic hydrology, *Water resources development, Markovian parameters, Discharge measurements, Dams, Hydrology, Mathematical studies, Stochastic process, Probabilistic process, Nile River, Aswan Dam, Egypt.

An Autoregressive model with Markovian parameters (ARMP/a.r.m.p.) and a feature prediction scheme (FRM) are developed. The ARMP is physically based and adaptive in is implementation, thus taking into consideration the inherent periodicities in hydrological time series. The FRM is motivated by the current inability to provide a suitable and sufficiently comprehensive yet simplified mathematical-hydrological model. It is based on pattern analysis and is such that a system's dynamic feature is predicted using a priori data which can subsequently be used to simulate the missing data and forecast future hydological parameters. The ARMP and FPM provide efficient alternatives to some other existing models which are not, in general, applicable to all classes of hydrological problems, with an added advantage of on-line forecasting. A comparitive analysis of the techniques was undertaken using the discharge record data from the River Nile at Aswan Dam from 1870 to 1945. It is further proposed that in order to enhance the overall performance of the prediciton scheme the FPM may be used as an input (training data) to the ARMP. It is expected that the application of these techniques to the analysis and synthesis of stream flows would yield very useful results in the design and operation of several hydraulic structures. The a.r.m.p. and the feature prediction techniques may be applied to other random processes in control, communication, physiological and other systems. (Baker-FRC)
W83-03060

COMPARING METHODS OF HYDROLOGIC REGIONALIZATION,
Geological Survey, Reston, VA.
For primary bibliographic entry see Field 7C.
W83-03146

2B. Precipitation

SEASONAL PATTERNS IN EXTREME 1-HOUR RAINFALLS,
Meteorological Service, Wellington (New Zealand).
K. J. A. Revfeim.
Water Resources Research, Vol 18, No 6, p 1741-1744, December, 1982. 1 Tab, 4 Ref.

Descriptors: *Seasonal variation, *Rainfall, Rainfall intensity, Model studies, Stochastic process.

The information content of monthly rainfall extremes is used to estimate simple harmonic coefficients of a rainfall model. Extreme rainfalls are assumed to occur as a periodic Poisson process with time-varying rate annd independent exponentially distributed amounts, where the mean of the exponential distribution also varies with a period of one year. Amplitudes of both recurrence and intensity were found to be significantly different from zero for a 31-year by 12-month record of 1-hour rainfall extremes. The phases of recurrence and intensity differ by approximately 6 months, so that the extreme events within a given time period are obtained using the monthly data base rather than the series of annual extremes. (Author's abstract)
W83-02932

2C. Snow, Ice, and Frost

NATURE AND EXTENT OF ACID SNOWPACKS IN PENNSYLVANIA,
Pennsylvania State Univ., University Park.
D. R. DeWalle, W. E. Sharpe, J. Izbicki, and D. L. Wirries.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-206276, Price codes: A03 in paper copy, A01 in microfiche. Institute for Research on Land and Water Resources Completion Report, Pennsylvania State Univ., University Park, February 1983. 35 p, 7 Fig, 5 Tab, 13 Ref, 1 Append. OWRT A-054-PA(1), 14-34-0001-9040.

Descriptors: *Acid rain, *Atmospheric deposition, *Snowpacks, *Sulfate, *Nitrate, *Lime dust, Hydrogen ions, Lead, *Pennsylvania, Ridge and Valley Province, Water quality, Ion balance, Quarries, Air quality, Water equivalent, Storm track, Snowfall, Heavy metals, Forests, *Hydrogen ion concentration.

Snowpack chemistry was evaluated with repeated surveys at 30 sampling sites across Pennsylvania during 1979-81. The mean snowpack pH of 4.25 for 280 samples was largely due to H+ from nitric acid. Snowpack sulfates were high, especially in the SW sector of the state where SO sub 2 emissions were also high, but did not originate only from sulfuric acid. Rain-on-snow and coastal storm snowpacks produced higher snowpack pH. Localized increases in snowpack pH were found due to additions of dust from limestone and dolomite quarry operations, especially in the central Ridge and Valley Province. Acid loading on the landscape from snow in Pennsylvania is controlled by the total amount of snowfall as well as variations in concentrations of chemical constituents. Lead concentrations in snow packs occasionally exceeded maximum contaminant levels prescribed for drinking water.
W83-02943

TRANSPORT OF WATER IN FROZEN SOIL: I. EXPERIMENTAL DETERMINATION OF SOIL-WATER DIFFUSIVITY UNDER ISOTHERMAL CONDITIONS,
Cold Regions Research and Engineering Lab., Hanover, NH.
Y. Nakano, A. Tice, J. Oliphant, and T. Jenkins.
Advances in Water Resources, Vol 5, No 4, p 221-226, December, 1982. 4 Fig, 1 Tab, 13 Ref.

Descriptors: *Mathematical equations, *Water transport, *Frozen ground, Isotherms, Permeability coefficient, Temperature effects.

A new experimental method for measuring the soil-water diffusivity of frozen soil under isothermal conditions is introduced. The theoretical justification of the method is presented, and the feasibility of the method is demonstrated by experiments conducted using marine deposited clay. The theorectical justification is made under the assumption that the soil-water diffusivity is proportional to some power of water content. This functional form of the soil-water diffusivity does not provide a close fit for the experimental data obtained. Thus the measured diffusivity must be considered approximate. The approximation was needed in analyzing experimental data because the mathematical theorems available at present are limited. Mathematical theorems for the more general case of diffusivity function are required to improve the accuracy in data analysis. (Baker-FRC)
W83-03054

MOBILIZATION, MOVEMENT AND DEPOSITION OF ACTIVE SUBAERIAL SEDIMENT FLOWS, MATANUSKA GLACIER, ALASKA,
Cold Regions Research and Engineering Lab., Hanover, NH.
For primary bibliographic entry see Field 2J.
W83-03116

CHEMISTRY OF SOUTH POLAR SNOW,
Laboratoire de Glaciologie et Geophysique de l'Environnement, Grenoble (France).
For primary bibliographic entry see Field 2K.
W83-03119

2D. Evaporation and Transpiration

WEATHER AND CONSUMPTIVE USE IN THE BEAR RIVER BASIN, IDAHO DURING 1982,
Idaho Univ., Moscow. Dept. of Agricultural Engineering.
R. G. Allen, and C. E. Brockway.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-202317. Idaho Water and Energy Resources Research Institute Completion Report, Univ. of Idaho, Moscow, January 1983. 107 p, 60 Fig, 6 Tab, 15 Ref, 1 Append. OWRT A-076-IDA(1), 14-34-0001-2114.

Descriptors: *Idaho, *Consumptive use, *Weather, Evapotranspiration, *Irrigation, *Dryland, Soil moisture, Neutron problem, Aridity, Wind, Temperature, Vapor pressure, Alfalfa, Winter wheat, Bear River basin, *Solar radiation.

Hourly measurements of solar radiation, wind travel, air temperature and dewpoint temperatures were recorded at three agricultural sites in the Bear River basin in Idaho during 1982. Evapotranspiration calculated from the water measurements using a Penman combination equation agreed well with soil moisture depletions measured with a neutron-probe at an irrigated alfalfa site. Advection-aridity relationships describing water use by dryland crops based on the microclimate environment estimated consumptive use quite well for dryland winter wheat and dryland alfalfa during most months. The SCS-Blaney-Criddle consumptive use method under-estimated water use by irrigated alfalfa but provided good estimates of water use by dryland winter wheat. The FAO-Blaney-Criddle method with elevation correction provided estimates equivalent to the Penman method. Weather and calculated evapotranspiration estimates in the Bear River portion of Idaho were similar to measurements recorded at Kimberly, Idaho, 240 km to the west, during the same time period, but were quite different from measurements recorded at Logan, Utah, 30 to 90 km to the south.
W83-02911

EVAPORATIVE FLUX FROM WHEAT AND FALLOW IN A SEMIARID CLIMATE,

Montana Agricultural Experiment Station, Bozeman.
J. K. Aase, and F. H. Siddoway.
Soil Science Society of America Journal, Vol 46, No 3, p 619-626, May/June, 1982. 12 Fig, 3 Tab, 15 Ref.

Descriptors: *Water stress, *Evapotranspiration, *Soil-water-plant relationships, Evaporation, Semiarid lands, Wheat, Fallowing, Water use efficiency, Energy loss, Dry farming, *Montana, Soil moisture.

The daily evaporative flux and energy balance components were measured in two adjacent 180m x 180m fields in Montana. The fields were alternately cropped and fallowed. Plantings were Olaf spring wheat in 1978 and 1979 and Roughrider winter wheat in 1979-1980. Rainfalls in the crop seasons were 33 cm in 1978 and 9 cm in each of 1979 and 1980. In spite of deficient precipitation in 1979 the crop was normal (4000 kg per ha) because the root zone soil profile was near field capacity in the spring. The 1980 crop was 1/3 that of the 1979 crop. Lysimeters in fallow and planted fields lost almost identical amounts of water until completion of tillering. Thereafter, evapotranspiration from cropped fields was much higher than evaporation from fallow fields. The fallowed lysimeter gained 12 cm of water in 1978, lost 7 cm in 1979, and lost 2,5 cm in1980. The cropped lysimeter lost 20 cm in 1978, 42 cm in 1979, and 14 cm in 1980. Sensible heat transfer to the crop strongly influenced evapotranspiration, except in 1980 when the crop was water stressed and contributed sensible heat downwind from the field. (Cassar-FRC)
W83-02965

EVAPOTRANSPIRATION BEFORE AND AFTER CLEARING PHREATOPHYTES, GILA RIVER FLOOD PLAIN, GRAHAM COUNTY, ARIZONA,
Geological Survey, Tucson, AZ. Water Resources Div.
R. C. Culler, R. L. Hanson, R. M. Myrick, R. M. Turner, and F. P. Kipple.
Available from the Distribution Br. USGS, 604 S. Pickett St. Alexandria, VA 22304, Price, $9.00. Geological Survey Professional Paper 655-P, 1982. 67 p, 25 Fig, 1 Plate, 21 Tab, 39 Ref.

Descriptors: *Evapotranspiration, *Phreatophytes, *Hydrologic budget, Energy, Flood plains, Vegetation, Soil moisture, Water conservation, *Arizona, Graham County, Gila River Phreatophyte Project, San Carlos Indian Reservation.

The U.S. Geological Survey made a water-budget study of evapotranspiration along a 15-mile reach of the Gila River, Arizona from 1962 to 1971. The study was designed to determine the change in evapotranspiration following phreatophyte removal from the river's flood plain. After an initial calibration period, the vegetation was removed beginning in 1967. Post-clearing attempts to establish grass were unseccessful and ephemeral plants provided the only plant cover during brief periods of moisture availability after clearing. The report shows that annual evapotranspiration on the project area averaged 43 inches before clearing, ranging from 56 inches for dense stands of phreatophytes to 25 inches on areas of no phreatophytes. After phreatophyte removal the average reduction in evapotranspiration was 19 inches per year and ranged from 14 inches to 26 inches depending on the density of phreatophytes prior to removal. The report notes that a flood plain without phreatophytes is in an artificial condition and that the reduced evapotranspiration is temporary and would not apply after permanent replacement vegetation became established. (USGS)
W83-02966

EVAPOTRANSPIRATION OF APPLIED WATER, CENTRAL VALLEY, CALIFORNIA, 1957-78,
Geological Survey, Sacramento, CA. Water Resources Div.
A. K. Williamson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-263385, Price codes: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 81-45, May 1982. 56 p, 11 Fig, 4 Tab, 30 Ref.

Descriptors: *Evapotranspiration, *Groundwater recharge, *Irrigation, *Water management, Hydrologic budget, Consumptive use, Irrigation efficiency, *California, Central Valley.

In the Central Valley, Calif., where 57% of the 20,000 square miles of land is irrigated, groundwater recharge from agricultural lands is an important input to digital simulation models of groundwater flow. Several methods of calculating recharge were explored for the Central Valley Aquifer Project and a simplified water budget was designed where net recharge (recharge minus pumpage) equals net surface water diverted minus evapotranspiration of applied water (ETAW). This equation eliminates the need to determine pumpage from the water-table aquifer, assuming that the time lag for infiltration is not longer than the time intervals of interest for modeling. This study evaluates only the evapotranspiration of applied water. Future reports will describe the other components of the water budget. ETAW was calculated by summing the products of ETAW coefficients and respective crop areas for each 7 1/2-minute quadrangle area in the valley, for each of three land-use surveys between 1957 and 1978. In 1975 total ETAW was 15.2 million acre-feet, a 43% increase since 1959. The largest increases were in the south, especially Kern County, which had a sixfold increase, which was caused by the import of surface water in the California Aqueduct. (USGS)
W83-02984

AN EXPERIMENTAL INVESTIGATION OF EVAPOTRANSPIRATION ESTIMATION METHODS,
Minnesota Univ., St. Paul. Dept. of Soil Science.
J. E. Ljungkull, and D. G. Baker.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-206813, Price codes, A08 in paper copy, A01 in microfiche. M.S. Thesis, August 1982. 143 p, 43 Fig, 15 Tab, 108 Ref, 8 Append. OWRT B-147-Minn(2), 14-34-0001-9119.

Descriptors: *Evapotranspiration, *Calculation methods, *Lysimeter, Evaporation, Transpiration, Hydrologic Cycle, Minnesota, Regression analysis, Pan evaporation, *Meteorological data, Soybeans, Alfalfa.

Using meteorological data collected during the 1978, 1979, and 1980 growing seasons at St. Paul, MN, estimates of daily potential evapotranspiration were made using thirteen different calculation methods. These estimates were then compared to measurements of actual evapotranspiration from a cropped surface obtained from the University of Minnesota's weighing lysimeter. The crop was soybeans in 1978 and 1979, and alfalfa 1980. Simple linear regression techniques were used to compare the estimated and measured values of evapotranspiration. Scatter plots showing the relationships between the predicted and observed values and histograms of the differences between the two are presented. Summary statistics for each regression and set of difference values are reported. It was found that pan evaporation was most successful at predicting daily evapotranspiration. The methods which combine energy balance and aerodynamic functions were the next best, followed by the methods using radiation and temperature as inputs. The methods based on temperature alone performed most poorly.
W83-03034

2E. Streamflow and Runoff

APPLICATION OF NUMERICAL SIMULATION TECHNIQUES TO FLOODPLAIN MANAGEMENT,
Nevada Univ. System, Reno. Desert Research Inst.
V. L. Gupta, J. W. Fordham, S. M. Afag, and J. M. Federici.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-196451, Price codes: A03 in paper copy, A01 in microfiche. Publication No 41080, Janaury 1983. 40 p, 4 Tab, 13 Fig, 19 Ref, 2 Append. OWRT B-096-NEV(2), 14-34-0001-7168.

Descriptors: *Floodplains, Floodplain studies, *Flood routing, Flood waves, Design flood, *Floodplain management, Numerical analysis, Finite difference method, *Simulation, *Sensitivity, Model studies, Tuckee River, *Nevada.

Presented herein is a case study of one dimensional modeling of spatially varied unsteady flow for the Truckee River. The study attempts to refine the currently used techniques in defining the floodplain for key reaches under various levels of flooding. Several different finite difference formulations of the Saint-Venant equations were compared for efficiency and sensitivity to various input parameters in an effort to identify the key parameters which determine model reliability. The basic model was found to be capable of reproducing historic floods and short duration hydrographs. The sensitivity analysis indicated that the most influential input parameter was the lateral flow regime. Therefore it is determined that an explicit description of tributary inputs is necessary together with adequate geometric description in the immediate vicinity of the confluence. With an adequate lateral inflow description the model was used to delineate the Standard Project and Intermediate Floodplains.
W83-02893

TURBULENT VERTICAL MOMENTUM TRANSFER IN STRATIFIED ENVIRONMENTS,
Nevada Univ. System, Las Vegas. Desert Research Inst.
R. H. French, and S. C. McCutcheon.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-196634, Price codes: A03 in paper copy, A01 in microfiche. Publication No 41079, March 1983. 32 p, 3 Fig, 5 Tab, 17 Ref. OWRT A-099-Nev(1), 14-34-0001-1130.

Descriptors: *Stratified flow, *Turbulent flow, *Momentum transfer, *Error analysis, Vertical mixing, Boundary layer vertical momentum, Hydraulics, Estuarine circulation.

A uniform data base is used to compare five hypotheses of vertical momentum transfer in stratified free surface flow in which the primary source of turbulence is bottom boundary shear. The hypotheses examined includes those of Rossby and Montgomery, Kent and Pritchard, Odd and Rodger, French, and McCutcheon. Of the hypotheses examined, four involve one or more free coefficients while the hypothesis of McCutcheon involves no free coefficients. Two general conclusions can be drawn. First, although the hypothesis of French yields excellent estimates of epsilon super s, this is an empirical theory whose coefficient values and accuracy should be verified with an independent data set. Second, the modified hypothesis of McCutcheon provides very reasonable estimates of epsilon super s especially when it is considered that this model involves no free coefficients. In comparing these hypotheses, the problem of experimental error was also considered. It is concluded that the traditional theories of mementum transfer in stratified flows all suffer from severe computational error problems. In fact, these difficulties are so severe that this factor alone may account for the problems other investigators have encountered in accurately determining values for the free coefficients.
W83-02901

HYDROLOGY, HYDRAULICS, AND SEDIMENT TRANSPORT, KANKAKEE AND IROQUOIS RIVERS,
Illinois State Water Survey Div., Champaign.
For primary bibliographic entry see Field 2J.
W83-02921

DEVELOPMENT OF A GENERALIZED HYDROLOGIC MODELLING SYSTEM,

North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
E. H. Wiser.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-206300, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Institute Completion Report, North Carolina State Univ., Raleigh, March 1983. 32 p, 8 Ref, 2 Append. OWRT A-097-NC(1), 14-34-0001-7070.

Descriptors: *Hydrologic models, *Stream discharge, Simulation analysis, Stream Flow, Simulation of stream flow, Model studies, *North Carolina, Streamflow data.

A system has been developed to permit convenient simulation of streamflow data at any point in the state of North Carolina. The user can by interactive use of a terminal specify watershed location and area, model and parameters for simulation at the point. The system is known as HMS (Hydrologic Modelling System). HMS leads the user through a series of questions by which the location, drainage area, model and parameters are determined. The user is always permitted to accept default values or modify parameters as desired. If the user can identify the location according to the labels used in the preceding NCSSARR study, the basin can be immediately specified. If not, a map of the state is used by which the appropriate basin code can be determined. The project as originally proposed was a comprehensive one, assuming the introduction of several models, devising methods of relating model parameters to watershed characteristics, and testing the models under various conditions. The project as finally approved is much more limited in scope. Only one model is included, information on selecting parameters is more limited, and no testing has been done. However, it is believed that the project has shown that the method is appropriate, at least for some models, and it certainly makes modelling more accessible.
W83-02946

STREAMFLOW CHARACTERISTICS RELATED TO CHANNEL GEOMETRY OF STREAMS IN WESTERN UNITED STATES,
Geological Survey, Lawrence, KS. Water Resources Div.
E. R. Hedman, and W. R. Osterkamp.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $3.25. Geological Survey Water-Supply Paper 2193, 1982. 17 p, 9 Fig, 3 Tab, 16 Ref.

Descriptors: *Streamflow, *Flow characteristics, *Channel morphology, *Streams, Flood frequency, Gaging stations, Hydrologic data, Surface water, Rainfall-runoff relationships, *Western United States, Active-channel geometry.

Assessment of surface-mining and reclamation activities generally requires extensive hydrologic data. Adequate streamflow data from instrumented gaging stations rarely are available, and estimates of surface-water discharge based on rainfall-runoff models, drainage area, and basin characteristics sometimes have proven unreliable. Channel-geometry measurements offer an alternate method of quickly and inexpensively estimating streamflow characteristics for ungaged streams. The method uses the empirical development of simple or multiple regression equations to yield a discharge value from channel-geometry and channel-material data. The equations are developed by collecting data at numerous stream-gaging sites and statistically relating those data to selected discharge characteristics. Mean annual runoff and flood discharges with selected recurrence intervals can be estimated for perennial, intermittent, and ephemeral streams. The equations were developed from data collected in the western half of the conterminous United States. The effects of the channel-material and runoff characteristics are accounted for with the equations. (USGS)
W83-02969

STREAMFLOW LOSSES TO MADISON GROUP ROCKS IN THE LITTLE BELT AND BIG SNOWY MOUNTAINS, MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
R. D. Feltis, and R. R. Shields.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-117929, Price codes: A02 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 82-49, August 1982. 16 p, 3 Fig, 7 Tab, 7 Ref.

Descriptors: *Streamflow depletion, *Stream discharge, *Flow measurement, *Flow rates, Data collections, Gaging stations, Sites, *Montana, Madison Group rocks, Little Belt Mountains, Big Snowy Mountains.

Four streams originating in the Little Belt and Big Snowy Mountains in central Montana were measured in 1975 to determine streamflow losses across outcrops of the Madison Group (Mississippian age). Based on streamflow data obtained for 39 months at two streamflow-gaging stations on the Middle Fork Judith River, the average daily loss was 9.1 cubic feet per second or about 6,600 acre-feet per year. Seepage measurements on other stream reaches indicated losses of 7.6 cubic feet per second on the south Fork Judith River, 9.2 cubic feet per second in Yogo Creek, as much as 64 cubic feet per second in Dry Wolf Creek, and about 60 cubic feet per second in Rock Creek. (USGS)
W83-02974

TECHNIQUES FOR ESTIMATING MAGNITUDE AND FREQUENCY OF FLOODS IN SOUTH CAROLINA,
Geological Survey, Columbia, SC. Water Resources Div.
B. H. Whetstone.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-118281, Price codes: A05 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 82-1, February 1982. 78 p, 13 Fig, 3 Tab, 7 Ref.

Descriptors: *Floods, *Frequency analysis, *Flood data, Streamflow, Regulated flow, Flood discharge, Flood peak, Gaging stations, Sites, *South Carolina.

Information is presented for estimating the magnitude and frequency of floods on streams in South Carolina. Flood-frequency characteristics for 151 gaging stations, were related to basin characteristics by multiple regression techniques for each of four physiographic provinces. Equations were derived to estimate flood magnitudes at recurrence intervals ranging from 2 to 100 years on streams with drainage areas greater than 1.0 square mile. Examples demonstrate the procedure for computing flood-frequency discharge for sites on gaged and ungaged streams in South Carolina. Relationships of flood discharge and frequency to drainage area are presented for the main stem of major streams. A compilation of flood records for gaging stations in South Carolina is presented as supplemental data. (USGS)
W83-02979

TECHNIQUES FOR ESTIMATING FLOOD DISCHARGES FOR UNREGULATED STREAMS IN NEW MEXICO,
Geological Survey, Albuquerque, NM. Water Resources Div.
R. P. Thomas, and R. L. Gold.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-264953, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigation 82-24, March 1982. 42 p, 2 Fig, 5 Tab, 23 Ref.

Descriptors: *Floods, *Streams, *Flood peak, *Regression analysis, *Data collections, Simulation analysis, Estimating, Flood recurrence interval, Flood frequency, Gaging stations, Sites, *New Mexico.

Equations for estimating flood magnitudes at selected recurrence intervals from 2 to 500 years were developed using multiple-regression analyses. These equations relate flood magnitudes to basin characteristics, contributing drainage area and site altitude, and only are applicable to unregulated streams in New Mexico that are relatively unaffected by urban runoff. Estimates of floods at or near gaged sites may be computed with an equation that adjusts discharges developed with the regression equations using station-specific discharges. (USGS)
W83-02981

FLOODS IN MAINE, APRIL-MAY 1979,
Geological Survey, Augusta, ME. Water Resources Div.
R. A. Fontaine, and C. R. Haskell.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-109454, Price codes: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 81-68, November 1981. 65 p, 8 Fig, 2 Tab, 1 Append.

Descriptors: *Floods, *Excess rainfall, *Snowmelt, *Hydrologic data, Runoff, Flood peak, Flood recurrence interval, Flood damage, Flood discharge, Storms, Gaging stations, Sites, *Maine.

Heavy rainfall during April 27-30, 1979, resulted in moderate to record flooding in much of northern and western Maine. During this period, rainfall totals of as much as 6 inches were measured. This period was preceded by up to 10 days of seasonally warm temperatures and snowmelt, which helped create conditions favorable to flooding later in the month. Flood peaks having recurrence intervals greater than 30 years were recorded at several sites, and a few sites experienced maximum recorded flood peaks with recurrence intervals in excess of 50 years. There was no loss of life, but local damage to homes and commercial and industrial establishments was significant. This report describes the flooding. A tabulation of peak gage heights and discharges is included for 42 sites. Daily and storm precipitation values are tabulated for 58 sites. (USGS)
W83-02983

STORAGE REQUIREMENTS TO SUSTAIN GROSS RESERVOIR OUTFLOW FROM SMALL BASINS IN KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
W. J. Carswell, Jr.
Kansas Water Resources Board Technical Report No 16, June 1982. 40 p, 18 Fig, 3 Tab, 8 Ref.

Descriptors: *Reservoir storage, *Small watersheds, *Carryover storage, Storage capacity, Streamflow, Annual runoff, Frequency distribution, Data collections, *Kansas, Probability routing.

Carryover and within-year storage requirements were used to determine the total storage required to sustain gross reservoir outflow from small basins in Kansas. Carryover storage requirements were defined using the probability-routing method and annual streamflows for unregulated streams with drainage areas of less than 300 square miles. Mass curve analysis of streamflows for each year was used to define within-year storage requirements. From these results, regional draft-storage curves for 2-, 5-, and 10-% chances of deficiency were developed and are presented as three-parameter plots of draft rate against mean annual runoff for selected levels of storage. These curves can be used to estimate the storage required to sustain gross reservoir outflow at sites where continuous streamflow records are not available. An evaluation of the accuracy of sustained gross reservoir outflow for a 2-% chance of deficiency calculated from regional relations indicated a root-mean-square error of 26%. Relations are included that can be used as a rough approximation to adjust draft-storage curves at ungaged sites for the effect of serial correlation. (USGS)
W83-02992

FLOW DURATION CURVES IN TROPICAL EQUATORIAL REGIONS,
Shawinigan Engineering Co. Ltd., Montreal (Quebec).
S. I. Ramsahoye.

International Water Power and Dam Construction, Vol 34, No 12, p 66-69, December, 1982. 3 Fig, 1 Tab, 5 Ref.

Descriptors: *Tropical regions, *Flow duration, *Streamflow forecasting, Rainfall-runoff relationships, Runoff, Surface runoff, Developing countries.

Development of hydropower in developing countries requires streamflow data, which is usually unavailable or inadequate for the ungaged upper catchments and mountains regions of the basins. A method of obtaining flow duration bypasses the usual streamflow simulation and uses the mean annual flow to calculate the average daily flow duration curve. Several approaches are given for computing the mean annual runoff. These recognize that incident annual solar radiation is reasonably constant and that runoff can be calculated from rainfall and temperature data. Preparation of the flow duration curve depends on the fact that flow duration coefficients are reasonably constant within a country or region of a country. The ratio of the theoretical to the measured flow for a selected % of flow exceedance is also reasonably constant. This permits preparation of average daily or monthly flow duration curves using short-term flows and long-term rainfall and temperature. This rapid method requires only a hand-held calculator. It cannot be used in regions where groundwater inflows or outflows are significant without adjustments for this component. (Cassar-FRC)
W83-03018

2F. Groundwater

UPDIP DELINEATION OF THE TERTIARY LIMESTONE AQUIFER, SOUTH CAROLINA,
South Carolina Univ., Columbia. Dept. of Geology.
D. J. Colquhoun, R. W. Oldham, J. W. Bishop, and P. D. Howell.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-196485, Price codes: A06 in paper copy, A01 in microfiche. Water Resources Research Institute Report No 97, Univ. of South Carolina, Columbia, December, 1982. 93 p, 4 Fig, 10 Ref. OWRT A-055-SC(1), 14-34-0001-2143.

Descriptors: *Catchment area, *Confined aquifer, *Confining beds, *Groundwater recharge, Geologic time, *Geologic mapping, Geologic units, Subsurface mapping, *Tertiary limestone aquifer, *South Carolina, Cooper Group, Orangeburg Group, Black Mingo Group, Middle Eocene, Late Eocene, Oligocene, Paleocene, Santee Limestone.

The Tertiary Limestone Aquifer is delineated in its updip area of South Carolina within the Orangeburg Group of middle Eocene (Claibornian, Lutetian) Age. The Orangeburg Group lies above the Black Mingo Group of Paleocene (Midwayian, Sabinian, Danian, Thanetian) and early Eocene (Wilcoxian, Ypresian) Age, and is separated by regional erosional unconformity. The Orangeburg Group lies below the Cooper group of Late Eocene (Priabonian/Bartonian) and Oligocene (Chattian) Age, and is separated by regional erosional unconformity. The Orangeburg Group results from marine submergence and emergence. It consists of several regionably mappable formations. From South (basinward) to North (source area ward) the Santee Limestone thins as over- and underlying siliciclastic formations thicken. The sequence below consists of Santee Limestone (carbonate shelf), Bamberg, formation (deep water siliciclastic shelf), Neeses formation and Congaree Formation (shallow water siliciclastic shelf). The sequence above consists of Santee Limestone and McBean Formation. North of the Santee Limestone pinchout Aiken formation is recognized where over- and underlying siliciclastic shelf units cannot be separated. The Aiken is generally of barrier complex origin. Recharge-discharge areas within and into the Tertiary Aquifer are mapped, both below and above the Orangeburg Group through examination of power auger, outcrop and geophysical logs of water and test wells.
W83-02896

AQUIFER PARAMETER PREDICTION BY NUMERICAL MODELING,
Georgia Inst. of Tech., Atlanta. School of Civil Engineering.
M. M. Aral, and E. L. Kuniansky.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-202325, Price codes: A05 in paper copy, A01 in microfiche. Environmental Resources Center Report No. ERC 02-83, Georgia Institute of Technology, Atlanta, March 1983. 83 p, 36 Fig, 51 Ref. OWRT A-091-GA(1), 14-34-0001-1111.

Descriptors: *Groundwater seepage, *Finite element method, *Aquifer parameter, Model studies, Transmissivity, Regression analysis, Algorithm.

The research analyzes two approaches which may be utilized in determining the two-dimensional areal description of transmissivity in a heterogeneous aquifer. Both approaches rely on accurate steady-state piezometric head data. The first approach involved the direct solution of the steady state groundwater seepage equation with transmissivity parameter chosen as the primary unknown. The Galerkin finite element method was used for this purpose, but proved to be numerically unstable for this problem. The second method examined was a nonlinear least squares regression technique combined with finite element solution of steady state groundwater seepage equation with piezometric head chosen as the primary unknown parameter. This is an iterative approach which automates the trial and error model calibration process. The technique is applied to field problems with considerable success and the algorithm shows promise as a viable alternative to manual trial and error approach.
W83-02912

DERIVATION OF VERTICALLY AVERAGED EQUATIONS DESCRIBING MULTIPHASE FLOW IN POROUS MEDIA,
Princeton Univ., NJ. Dept. of Civil Engineering.
W. G. Gray.
Water Resources Research, Vol 18, No 6, p 1705-1712, December, 1982. 1 Fig, 1 Tab, 13 Ref.

Descriptors: *Porous media, *Aquifers, *Groundwater movement, Representative elementary volume technique.

An extension of the REV (representative elementary volume) averaging technique, used to derive balance equations for multiphase or porous media flow problems, is presented. Theorems which allow a one-step transformation from three-dimensional point equations for a single phase to two-dimensional point equations for multiphase systems are derived. The theorems are then applied to obtain the vertically averaged balance equations of mass, chemical species, momentum, energy, and entropy. The relation between these equations and their unaveraged predecessors is clearer than when the standard two-step averaging procedure is applied. Furthermore, constitutive relations are more easily hypothesized for the current system of equations than for previously derived forms. (Author's abstract)
W83-02930

PRELIMINARY STUDIES OF THE RESERVOIR CAPACITY AND THE GENERATING POTENTIAL OF THE BACA GEOTHERMAL FIELD, NEW MEXICO,
California Univ., Berkeley. Lawrence Berkeley Lab.
G. S. Bodvarsson, S. Vonder Haar, M. Wilt, and C. F. Tsang.
Water Resources Research, Vol 18, No 6, p 1713-1723, December, 1982. 11 Fig, 2 Tab, 21 Ref.

Descriptors: *Geothermal resources, *Transmissivity, *Groundwater reservoirs, Baca Geothermal Field, *New Mexico, Permeability.

The Baca Geothermal field at Valles Caldera, New Mexico, may not be able to supply enough steam to operate a 50 MW powerplant for 30 years, according to simulation studies using published data. Although the estimated reservoir reserves of 1 trillion kg of hot fluid over a 40 sq km area were considered adequate, the low transmissivity would cause localized boiling and rapid pressure decline during exploitation. Transmissivity values of the Baca reservoir (1830 md m) are an order of magnitude lower than in successfully developed fields. The numerical simulator SHAFT79 was used to estimate longevity. In none of the 5 cases (1 closed reservoir, 1 infinite reservoir, and 3 injection) could the flow rate be maintained longer than 15 years. For variable production rates a reservoir life of 25-49 years is indicated. (Cassar-FRC)
W83-02935

GEOTHERMAL RESOURCES IN THE BANBURY HOT SPRINGS AREA, TWIN FALLS COUNTY, IDAHO,
Geological Survey, Boise, ID. Water Resources Div.
R. E. Lewis, and H. W. Young.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $3.50. Geological Survey Water-Supply Paper 2186, 1982. 27 p, 13 Fig, 5 Tab, 21 Ref.

Descriptors: *Geothermal studies, *Thermal springs, *Water temperature, *Water analysis, Water use, Wells, Water level fluctuations, Stable isotopes, Radioisotopes, Heat balance, *Idaho, Banbury Hot Springs.

Thermal water (30.0 to 72.0 degrees Celsius) is produced from 26 wells and 2 springs in the vicinity of Banbury Hot Springs near Buhl, Idaho. Thermal water is used for space heating of private residences, catfish and tropical fish production, greenhouse operation, swimming pools, and therapeutic baths. In 1979, 10,300 acre-feet of thermal water was utilized; heat discharged convectively from the geothermal water was utilized; heat discharged convectively from the geothermal system was about 1.09x10 to the 7th power calories per second. Decline in artesian head and discharge apparent in recorder charts from two wells may represent seasonal fluctuations or may reflect aquifer response to development of the resource. Thermal waters sampled are sodium bicarbonate in character and slightly alkaline. Mixing of a hot (72 degrees Celsius) water with local, cooler ground water can be shown from various relations between stable isotopes, chloride, and enthalpy. On the basis of concentration of tritium, age of the waters sampled is at least 100 years and perhaps more than 1,000 years. One water (33 degrees Celsius) may be as young as 29 years. On the basis of silica, sodium-potassium-calcium, and sulfate-water geothermometers, best estimate of the maximum reservoir temperature for the thermal waters is between 70 and 100 degrees Celsius. (USGS)
W83-02972

GEOLOGIC AND WELL-CONSTRUCTION DATA FOR THE H-7 BOREHOLE COMPLEX NEAR THE PROPOSED WASTE ISOLATION PILOT PLANT SITE, SOUTHEASTERN NEW MEXICO,
Fenix and Scisson, Inc., Tulsa, OK.
For primary bibliographic entry see Field 4B.
W83-02977

AQUIFER TEST RESULTS, GREEN SWAMP AREA, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
C. H. Tibbals, and H. F. Grubb.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-117903, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 82-35, 1982. 29 p, 17 Fig, 2 Tab, 13 Ref.

Descriptors: *Aquifer testing, *Transmissivity, *Storage coefficient, *Leakage, Artesian aquifer, Limestone, Confining beds, *Hydraulic diffusivity, *Florida, Green Swamp area, Floridan aquifer.

An aquifer test conducted in the Green Swamp area December 15-16, 1975 was designed to stress the uppermost part of the Floridan aquifer so that the leakage characteristics of the overlying confin-

ing bed could be determined. A well tapping the upper part of the Floridan aquifer was pumped at a rate of about 1,040 gallons per minute for 35 hours; drawdown was measured in the Floridan aquifer and in two horizons in the confining bed. Analysis of the data indicates that the transmissivity of the uppper 160 feet of the Floridan is 13,000 square feet per day, the storage coefficient is about 0.0002.5, and the overlying confining bed leakance coefficient is about 0.02 to 0.025 per day. The vertical hydraulic diffusivity of the confining bed ranged from 610 square feet per day to 16,000 square feet per day. Results of the test indicate that, in the area of the test site, a Floridan aquifer well field would induce additional recharge to the Floridan. As a result of that increased recharge, water levels in the surficial aquifer would tend to stand lower, runoff from the area would tend to be less, and, perhaps, evapotranspiration would be less than normal.(USGS)
W83-02980

GEOLOGY AND GROUND-WATER RESOURCES OF OSWEGO COUNTY, NEW YORK,
Geological Survey, Ithaca, NY. Water Resources Div.
T. S. Miller.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-124651, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 81-60, 1982. 37 p, 28 Fig, 1 Tab, 44 Ref.

Descriptors: *Groundwater, *Glacial aquifers, *Geology, *Aquifer characteristics, Glacial drift, Fracture permeability, Wells, *New York, Oswego County.

Unconsolidated deposits of Pleistocene and Holocene age form a nearly continuous cover in Oswego County. Pleistocene deposits consist of lodgment and ablation tills, outwash, kame, beach and wave-delta sand and gravel, and lacustrine sand, silt, and clay. Holocene deposits consist of peat and muck deposited in wetlands, and alluvial silt, sand, and gravel deposited in stream valleys. Unconsolidated deposits contain sufficient water for domestic and small farm needs except in areas mantled by silt and clay. Sand and gravel deposits are the best source of large quantities of water. Aquifers in glacial outwash are common in the eastern Tug Hill region, whereas kame, eskerkame, and beach aquifers predominate in the eastern and central regions. The principal sand and gravel aquifer, known as the Lacona-Williamstown aquifer, is 20 miles long, 0.5 to 3 miles wide, and 10 to 85 feet thick. Wells tapping the aquifer yield from 220 to 800 gallons per minute. Fracturing, rather than rock type, is the controlling factor in the water-producing capacity of bedrock. Bedrock near or at land surface provides adequate supplies for domestic and farm needs. Shallow wells in bedrock have water of fair to good quality, but material content increases with depth. (USGS)
W83-02987

GROUND-WATER RESOURCES OF THE ARCADIA-MINDEN AREA, LOUISIANA,
Geological Survey, Baton Rouge, LA. Water Resources Div.
G. N. Ryals.
Louisiana Department of Public Works Water Resources Technical Report 28, 1982. 35 p, 4 Fig, 3 Plates, 10 Tab, 18 Ref.

Descriptors: *Groundwater, *Groundwater availability, *Aquifer characteristics, *Water yield, Aquifer testing, Geohydrologic units, Wells, Drawdown, Water table, Water level, Water supply, Water use, Water quality, Chemical analysis, Ion exchange, Hydrologic data, *Louisiana, Arcadia-Minden area.

The Sparta Sand aquifer of Eocene age yields 97% of the water used in the Arcadia-Minden area of north-central Louisiana along Interstate Highway 20 and U.S. Highway 80. Pumpage from the Sparta aquifer in 1980 was 6.2 million gallons per day. The potentiometric surface, which about 150 to 400 feet above the principal Sparta sands, is declining at the rate of 1/2 to 4 feet per year. As hydraulic conditions change from artesian to water table, the rate of decline will decrease. Generally, water from the Sparta aquifer meets the U.S. Environmental Protection Agency drinking-water standards. The Wilcox Group of Paleocene-Eocene age contains freshwater only in the southwestern part of the area. Pumpage was only 0.2 million gallons per day in 1980. Freshwater in the Wilcox meets the U.S. Environmental Protection Agency drinking-water standards except at some sites where iron concentrations are excessive. The terrace aquifer, which occurs in the western part of the study area, can be used to supplement supplies from the Sparta and Wilcox aquifers for small domestic wells. The Arcadia, Bistineau, Gibaland, Minden, and Vacherie salt domes are disturbances caused by the local intrusion of salt. The vertical salt movements have disrupted the base of freshwater in the vicinity of the domes; however, the area affected is only about 4 square miles at each dome. (USGS)
W83-02991

HYDROLOGY OF THE SURFICIAL AQUIFER IN THE FLOYD RIVER BASIN, IOWA,
Geological Survey, Iowa City, IA. Water Resources Div.
K. D. Wahl, M. J. Meyer, and R. A. Karsten.
Available from Iowa Geological Survey, 123 N. Capitol St., Iowa City, Iowa 52242. Iowa Geological Survey Water-Supply Bulletin No 12, 1982. 53 p, 18 Fig, 5 Plates, 17 Tab, 36 Ref.

Descriptors: *Surface-groundwater relations, *Geohydrology, *Water quality, *Water use, Streamflow, Flow duration, Low flow, Aquifers, Groundwater movement, Groundwater recharge, *Iowa, Floyd River basin.

The Floyd River basin drains 960 square miles in northwest Iowa. Most of the basin is underlain by glacial drift of Pleistocene age which is in turn underlain by rocks of Cretaceous age. The major stream valleys and adjacent terraces commonly are underlain by alluvial sand-and-gravel beds. These sand-and-gravel beds and older sand-and-gravel beds in the glacial drift comprise the surficial aquifer. The surficial aquifer is recharged by local precipitation and discharges into the Floyd River drainage system. Water use in the basin is largely for public supply and rural-domestic or rural livestock use. The water is of suitable chemical for all uses, although it is hard and has large concentrations of sulfate in some areas. (USGS)
W83-02993

GROUNDWATER RESOURCES IN THE JUAREZ-EL PASO REGION (DE AGUAS SUBTERRANEAS EN LA REGION DE JUAREZ-EL PASO),
Escuela Superior de Agricultura Hermanos Escobar, Chihuahua (Mexico). Area de Manejo de Agua y Suelo.
C. A. Rincon Valdes.
Natural Resources Journal, Vol 22, No 4, p 939-941, October, 1982. English summary.

Descriptors: *Groundwater basins, *Geohydrology, *Groundwater management, Groundwater recharge, Groundwater depletion, Water allocation, Water demand, Water use, El Paso, Texas, Juarez, *Mexico.

The Juarez-El Paso Valley, which encompases 52,839 hectares of irrigable land, runs along the Rio Grande on the U.S.-Mexico border. Although agricultural development in this region is possible only through irrigation, the economies of both Juarez and El Paso depend largely on agriculture and cattle. The primary sources of groundwater in the region are the Hueco Bolson, the Mesilla Bolson, and the Rio Grande alluvium. The groundwater of the three basins is hydrologically connected, flowing from areas of recharge to areas of drainage. The Hueco Basin is recharged at a rate of about 7 million cubic meters per year, while depletion occurs at a rate of about 18 million cubic meters per year. Recharge of the Mesilla Basin is estimated at about 22 million cubic meters annually, while its rate of depletion is about 14 million cubic meters per year. The Rio Grande alluvium is recharged at a rate of about 98 million cubic meters per year, while depletion is about 29 million cubic meters annually. Pump wells account for most of the extraction of water resources both of the Rio Grande alluvium and of the Hueco Basin. The Juarez Water and Drainage Board reports that the volume of water pumped in Juarez tripled between 1968 and 1981. Official agencies in Mexico carefully control municipal and agricultural use of water, levying fines and/or reducing water supplies for prescribed periods of time against users who waste water. The states of Chihuahua and Texas should work together to protect the water resources of the area and to promote conservation, since their groundwater supplies are interconnected. (Carroll-FRC)
W83-03020

GEOTHERMAL RESOURCES IN THE NORTHWESTERN BORDER (RECURSOS GEOTHERMICOS EN LA FRONTERA NOROCCIDENTAL),
J. Eibenschutz.
Natural Resources Journal, Vol 22, No 4, p 991-997, October, 1982. English summary.

Descriptors: *Geothermal power, *Electric power production, *Resources development, Natural resources, Electric powerplants, Water demand, Water use, *Mexico, Valley of Mexicali.

The Valley of Mexicali, located in a rift zone, has been estimated to contain a geothermal production potential of between 850 and 1,700 megawatts of electric power capacity using current technology. Cerro Prieto, one of the areas of the valley, already has an operating capacity of 180 megawatts. Two more plants, with capacities of 220 megawatts each, are being constructed for operation in 1983 and 1984, respectively. In addition to the electricity producing application of the geothermal fluids, a process for the production of potassium chloride has been developed, which involves evaporating the brine in a solar pond, followed by further crystallization of the residues. Some processes are also being developed for the utilization of the hot water in such applications as hydroponics and aquaculture. Collaboration with bordering agencies involved in geothermal energy has resulted in beneficial exchange of technical information. Agreements have been signed with San Diego Gas and Electric Company and with Southern California Edison for the export of a total capacity of 275 megawatts. (Author's abstract)
W83-03021

USE OF GEOLOGIC AND WATER YIELD DATA FROM GROUND WATER BASED COMMUNITY WATER SYSTEMS AS A GUIDE FOR GROUND WATER PLANNING AND MANAGEMENT,
North Carolina State Univ. at Raleigh. Dept. of Marine, Earth and Atmospheric Sciences.
For primary bibliographic entry see Field 4B.
W83-03046

MODELING DIRECT RECHARGE OF SURFICIAL AQUIFERS,
Minnesota Univ., St. Paul. Dept. of Agricultural Engineering.
B. D. Knoch, D. C. Slack, and C. L. Larson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-208611, Price codes: A06 in paper copy, A01 in microfiche. Water Resources Research Center Completion Report, Univ. of Minnesota, St. Paul, April 1983. 105 p, 30 Fig, 8 Tab, 137 Ref, 1 Append. OWRT A-043-MINN(1), 14-34-0001-0125.

Descriptors: *Groundwater, *Groundwater recharge, *Recharge modeling, Soil moisture, Infiltration, Evapotranspiration, Model studies, *Simulation analysis, *Computer models, Water table levels, *Minnesota Andover, Frozen soil.

A one-dimensional, physically-based computer model was developed for predicting direct groundwater recharge. The model was verified using three years of data from an instrumented site in

east central Minnesota. Although the processes of infiltration and redistribution during frozen soil periods were not modeled, the model is capable of operating during both frozen and non-frozen soil periods. The model includes submodels for evapotranspiration, soil water extraction, snowmelt, surface depressional storage, infiltration and redistribution. The model predicts water table level and soil moisture. Water extraction may also be modeled. The model predicted both water table levels and soil moisture with reasonable accuracy over the three year period modeled.
W83-03101

2G. Water In Soils

MIDSEASON SOIL WATER RECHARGE FOR CORN IN THE NORTHWESTERN CORN BELT,
Michigan Agricultural Experiment Station, East Lansing.
B. S. Johnson, G. R. Blake, and W. W. Nelson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-205351. Water Resources Research Center Completion Report, Univ. of Minnesota, St. Paul, March 1983. 20 p, 6 Fig, 3 Tab, 12 Ref. OWRT A-042-MINN(1).

Descriptors: *Soil water storage, *Soil water recharge, *Subsurface moisture, Irrigation, Water conservation, *Corn, Northern Great Plains, *Minnesota, *Clay loam, *Crop yield.

Field experiments were conducted from 1979-82 on a Nicollet clay loam soil to determine the effects of midseason soil water recharge on corn production. Six treatments consisting of timing and amount variables of supplemental water additions were studied. Extensive soil water depletion to 90 cm occured in both 1980 and 81, the water table could not be detected within 200 cm of the soil surface in 1981. Despite these diverse conditions, positive significant grain yield resulting from the midseason application of 7.6 cm of water exceeded grain yield with natural precipitation by 1808, 2730, and 1947 kg/ha in 1979, 80, and 81, respectively. Grain production was enhanced as effectively by single-midseason applications of 7.6 cm of water as by 'optimum irrigation' (application of 3.8 cm at 50% depletion of plant-available water to a soil depth of 90 cm). In the presence of a receding water table (1980), 90% of the grain yield variability and 92% of the variability in total dry matter production (TDMP) was accounted for by the amount of supplemental water added and early-season water table depth. Response to the addition of supplemental water diminished with decreasing early-season water table depth.
W83-02890

TEST OF AN EQUATION FOR EVAPORATION FROM BARE SOIL,
British Columbia Univ., Vancouver. Dept. of Soil Science.
M. D. Novak, and T. A. Black.
Water Resources Research, Vol 18, No 6, p 1735-1737, December, 1982. 3 Fig, 11 Ref.

Descriptors: *Soil water, *Evaporation, *Advection, Idso equations, Priestley-Taylor equations, Agassiz, *British Columbia.

An empirical equation developed by Idso et al. (Water Resources Research, Vol 15, p 487-488, 1979) at Phoenix, Arizona, to calculate daily average evaporation rates during all three drying stages of a bare soil was tested using measurements made at Agassiz, British Columbia, and is discussed on the basis of available evaporation theory. The results show that these authors' expression for potential evaporation rate did not apply at Agassiz due to differences in the advection regimes at the two locations. The Agassiz potential evaporation rate data was well represented by the Priestley-Taylor equation with alpha = 1.27 + or - 0.1. It was concluded that the Idso et al. equation for potential evaporation has no greater generality than the Priestley-Taylor or other such semiempirical approaches. The concept of expressing the stage III rate as proportional to the expression for potential evaporation rate worked marginally well at a cultipacked site and quite well at a disc-harrowed site. It was concluded that for soils with stage III rates much greater than 50% of potential evaporation rate, more complete procedures are necessary for calculating evaporation rates during extended drying periods. (Author's abstract)
W83-02929

ON SUBSURFACE STORMFLOW: PREDICTIONS WITH SIMPLE KINEMATIC THEORY FOR SATURATED AND UNSATURATED FLOWS,
Virginia Univ., Charlottesville. Dept. of Environmental Sciences.
K. Beven.
Water Resources Research, Vol 18, No 6, p 1627-1633, December, 1982. 5 Fig, 1 Tab, 26 Ref.

Descriptors: *Hydrographs, *Subsurface flow, *Soil water, Rainfall, Model studies, *Storm water, East Twin Brook Catchment, *United Kingdom, Slopes, Unsaturated flow, Saturated flow.

Analytical solutions for partial and full equilibrium hydrographs of subsurface stormflow are presented for permeable soils on steep slopes. Solutions are based on kinematic approximations in both unsaturated and saturated zones. The analysis is restricted to constant rainfall intensities and simply defined functional relationships of saturated hydraulic conductivity, porosity, and soil moisture characteristics with depth in the soil profile. Solutions for rising, falling, and partial equilibrium hydrographs are given. Application of the model to data collected by Weyman (1970-1973) on a slope segment of the East Twin Brook catchment, Mendip Hills, United Kingdom, showed agreement between observed and calculated hydrographs. (Cassar-FRC)
W83-02931

TIME-DEPENDENT, LINEARIZED TWO-DIMENSIONAL INFILTRATION AND EVAPORATION FROM NONUNIFORM AND NONPERIODIC STRIP SOURCES,
Karadeniz Teknik Univ., Trabzon (Turkey). Dept. of Civil Engineering.
V. Batu.
Water Resources Research, Vol 18, No 6, p 1725-1733, December, 1982. 10 Fig, 20 Ref.

Descriptors: *Infiltration, *Irrigation design, *Evaporation, Sprinkler irrigation, Furrow irrigation, Porous media, Unsaturated flow, Soil water, Model studies, Hydraulic conductivity, Model studies.

Using a linearized equation describing unsaturated homogenous and isotropic porous media flow, a general, two-dimensional, time-dependent mathematical model is presented for infiltration and/or infiltration-evaporation from nonuniform and nonperiodic strip sources located at the soil surface. The analysis is based on an exponential relationship between the unsaturated hydraulic conductivity and the soil water pressure head and also assumes a constant value for the derivative of unsaturated hydraulic conductivity with respect to water content. In the mathematical analysis, Laplace transform and Fourier analysis techniques are used simultaneously, and a general equation in an integral form for the distribution of matric flux potential has been obtained. The result of Warrick and Lomen (1976) for a single strip source is shown to be a special case of this general model. The solution for infiltration from two strip sources is presented as another special case. Also, a third special case is presented for infiltration from two strip sources and evaporation from another strip located in the middle part. The horizontal and vertical flux components for these cases are presented. All results are expressed in integral forms and calculated with a computer using a numerical integration method. The solutions predict the matric flux potential and flux components as functions of space and time. Examples that illustrate the applicability of some of the solutions are presented. These solutions are of interest in the design of both sprinkler and furrow irrigation systems. The results may also be used for different purposes in civil and agricultural engineering applications. (Author's abstract)
W83-02938

SPATIAL VARIABILITY OF SURFACE TEMPERATURE ALONG TWO TRANSECTS OF A BARE SOIL,
California Univ., Davis. Dept. of Land, Air and Water Resources.
M. Vauclin, S. R. Vieira, R. Bernard, and J. L. Hatfield.
Water Resources Research, Vol 18, No 6, p 1677-1686, December, 1982. 13 Fig, 4 Tab, 27 Ref.

Descriptors: *Sampling, *Soil temperature, *Soil water, *Soil surfaces, Temperature, Spatial distribution, Variability, Davis, *California, Sprinkler irrigation, Irrigation, Infrared thermometers, Statistical analysis, Soil physics, Correlation analysis, Remote sensing.

The spatial variability of surface temperature on bare soil was measured at 1-2 p.m. on 3 consecutive days after sprinkler irrigation in a 1 ha field at Davis, California. Temperatures were measured at every meter along two transects (60 and 100 m long) with two infrared thermometers differing only in their field of view. Soil samples were collected on the third day to determine the water content in the 5 cm upper layer. Semivariograms and auto-correlation functions were determined and their measurements found to be correlated over space. A first-order autoregressive process with a white noise described the spatial structure of all data sets. Sampling of surface temperature and surface wetness along transects or over a grid at regular intervals rather than random locations gives more reliable ground truth data to use with remote sensing. (Cassar-FRC)
W83-02940

WATER DIFFUSIVITY OF A FIELD SOIL,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Environmental Mechanics.
B. E. Clothier, and I. White.
Soil Science Society of America Journal, Vol 46, No 1, p 155-158, January/February, 1982. 3 Fig, 8 Ref.

Descriptors: *Porosity, *Soil physical properties, *Infiltration, Soil water, Diffusivity, Sand, Bungendore sand, Absorption, Pore size, Soil porosity, *Biopores.

The wetting diffusivity of a Bungendore fine sand in the undisturbed state and repacked in the laboratory, were compared. The repacked sand had a near-rectangular profile of absorption, showing that the diffusivity is strongly dependent on soil water content. However, the undisturbed sand had a flatter absorption profile and a diffusivity that did not vary as strongly with soil water content. Thin section micromorphology showed that the repacking had reduced the continuity of biogenic mesopores, 0.1 to 1 mm in diameter, present in the undisturbed soil. These are formed by plant roots, fungal hyphae, or soil microfauna. Although repacking the soil did not significantly change the total porosity of the soil, the pore size distribution was shifted toward fewer, larger pores. (Cassar-FRC)
W83-02995

WATER ADSORPTION AND SWELLING OF CLAY MINERALS IN SOIL SYSTEMS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agronomy.
J. C Parker, D. F. Amos, and L. W. Zelazny.
Soil Science Society of America Journal, Vol 46, No 3, p 450-456, May/June, 1982. 5 Fig, 3 Tab, 26 Ref.

Descriptors: *Soil absorption capacity, *Porosity, *Compaction, Soil physical properties, Adsorption, *Clays, Soil compaction, Soil water, Soil porosity, Expansion, Wetting.

The effects of compaction and cyclic wetting and drying were evaluated for two soils: Poplimento

(9% montmorillonite and 11% vermiculite) and Iredell (48% montmorillonite and 15% vermiculite). Soil samples were left undisturbed or compacted at three soil moistures: optimum, below optimum, and above optimum. In Poplimento samples initial wetting produced small volume changes, suggesting that changes in soil moisture with increasing moisture during compaction counteracted normal moisture-dependent differences by reducing expansion space into large voids or by increasing expansion from entrapped air pressures, strain relaxation, and differential strain. Compacted Iredell samples showed an inverse relationship between moisture at compaction and swelling during initial wetting. Expansion during the second wetting followed the order: Poplimento--undisturbed = optimum = above optimum > below optimum; and Iredel--optimum > undisturbed = above optimum > below optimum. Values for swelling attributable to entrapped air pressures did not reflect the inverse relationship between entrapped air pressures and probable pore size suggested by the Laplace equation. The discrepancy may be explained by rate of water uptake and resistance to expansion. Intracrystalline swelling accounted for < 10% of total expansion in samples. Discrepancies between swelling and expansion were related to crystal strain relaxation and differential stress between adjacent crystals or aggregates. This effect increased with increasing compaction moisture for Poplimento and was unaffected by treatment for Iredell. (Cassar-FRC)
W83-02996

ABSORPTION OF WATER BY SOIL: THE EFFECT OF A SURFACE CRUST,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Environmental Mechanics.
D. E. Smiles, J. H. Knight, and K. M. Perroux.
Soil Science Society of America Journal, Vol 46, No 3, p 476-481, May/June, 1982. 8 Fig, 1 Tab, 12 Ref.

Descriptors: *Infiltration, *Soil physics, *Soil surfaces, Absorption, Soil water, Soil absorption capacity, Impervious membranes, Membranes, Surface sealing, Permeability.

The one-dimensional absorption of water by a uniform soil through a relatively impermeable surface crust was analyzed by conventional soil physics theory. This permitted calculation of the changing water potential at the soil-crust interface, the water content profiles, and the cumulative volume of water absorbed. This approach was used for situations where the conductance of the crust is constant. Experimental data using columns of fine sand confirmed the theory and demonstrated that the space- and time-like variables of Ahuja and Swartzendruber (1973) and the two variables, cumulative volume of water absorbed by the soil and the reduced flux at the surface, provide a useful set of reduced coordinates for describing adsorption through a membrane with a constant conductance. (Cassar-FRC)
W83-02997

STRATIGRAPHY AND WATER TABLE RELATIONSHIPS OF UPLAND LOESS-DERIVED SOILS IN SOUTH-CENTRAL IOWA,
Iowa State Univ., Ames. Dept. of Agronomy.
T. L. Coleman, and T. E. Fenton.
Soil Science Society of America Journal, Vol 46, No 1, p 82-87, January/February, 1982. 8 Fig, 4 Tab, 14 Ref.

Descriptors: *Water table, *Geomorphology, *Stratigraphy, *Iowa, Loess, Paleosols, Drainage, Soil water table, Yarmouth-Sangamon surface, Groundwater level, Seasonal variation.

The effects of stratigraphy and landscape position on water table levels in loess soils were studied in southcentral Iowa. Here the loess-covered primary divides reach their maximum width and minimum depth. The buried geomorphic surface (Yarmouth-Sangamon surface) is at its minimum depth with respect to the soil surface. The water table, also minimum in this region, fluctuates during the year. Monthly measurements of depth to water table were made along two geographically linear traverses on primary divides during 1978 and 1979. The depth of loess on the flat and sloping primary divides decreased with distance from the major loess source area, the Missouri River Valley. Natural drainage became poorer as the loess layer became thinner. On the flat and sloping divides the highest water tables were seen in the spring, and the lowest during fall. Water table depths were less cyclic in shallower loess layers. Negative correlations were found between depth to water table and capillary porosity of the B and C horizons, total porosity of the B horizon, and rainfall. Positive correlations were found between depth to water table and total porosity of the C horizon and temperature. (Cassar-FRC)
W83-02998

SOIL HYDRAULIC PROPERTIES AS STOCHASTIC PROCESSES: II. ERRORS OF ESTIMATES IN A HETEROGENEOUS FIELD,
Agricultural Research Organization, Bet-Dagan (Israel). Div. of Soil Physics.
D. Russo, and E. Bresler.
Soil Science Society of America Journal, Vol 46, No 1, p 20-26, January/February, 1982. 6 Fig, 1 Tab, 9 Ref.

Descriptors: *Stochastic process, *Soil properties, *Error analysis, Hydraulic properties, *Spatial distribution, *Kriging technique, Variation coefficient, Statistical analysis, Hydraulic conductivity.

Results of integral scales and coefficient of variation (C.V.) from Part I of this study D. Russo and E. Bresler, (Soil Science Society of Americal Journal, Vol 45, p 682-687, 1981) are applied to evaluate errors in estimating average values of several hydraulic properties. Based on the Ergodic Hypothesis and on standard statistical theory, an equation is derived to calculate the total field area and number of measurements needed to estimate (for a prescribed error) ensemble averages of a given hydraulic property. For a 0.8 ha field with 90 measurements performed to estimate mean values of various hydraulic properties, the errors are in the range between 7 and 46%. Various combinations of number of intergral scales (I) and number of measurements (N) are used to estimate mean values of a given hydraulic property with a given error. An 'optimal' I-N combination is derived. With this approach, 4 to 156 integral scales and 2 to 190 measurements are needed to estimate man values of the various hydraulic properties with 20% error. The kriging technique and fictitious point method are used to evaluate number and locations of additional observation points needed to estimate mean value of the saturated hydraulic conductivity (Ks) over a finite field with a given accuracy. To obtain the C.V. of Ks of 2.5% nine additional points are required. (Author's abstract)
W83-02999

TEMPERATURE DEPENDENCE OF UNSATURATED HYDRAULIC CONDUCTIVITY OF TWO SOILS,
Geological Survey, Menlo Park, CA. Water Resources Div.
J. Constantz.
Soil Science Society of America Journal, Vol 46, No 3, p 466-470, May/June, 1982. 4 Fig, 5 Tab, 14 Ref.

Descriptors: *Temperature effects, *Hydraulic conductivity, *Soil properties, Permeability, Soil water potential, Viscosity, Surface tension, Hanford sandy loam, Oakley sand.

Steady state evaporative flux experiments were run at uniform soil temperatures of 2, 25, and 45C for packed columns of Hanford sandy loam and Oakley sand. Soil matric potentials were measured, unsaturated hydraulic conductivities were calculated, and water retention characteristics (to -100 kPa) were determined. Results obtained from this study were at least an order of magnitude different from those obtained from an equation that relates unsaturated hydraulic conductivity to the intrinsic permeability, the relative permeability, and the viscosity of water. It considers that viscosity is the only parameter which changes with temperature. Results obtained from the soil columns show a much greater temperature dependence in the unsaturated conductivity than predicted by the equation. Results suggest that the relative permeability may be a function of temperature and water content. (Cassar-FRC)
W83-03000

HYDRODYNAMIC DISPERSION DURING UNSTEADY, UNSATURATED WATER FLOW IN A CLAY SOIL,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Environmental Mechanics.
D. E. Smiles, and B. N. Gardiner.
Soil Science Society of America Journal, Vol 46, No 1, p 9-14, January/February, 1982. 2 Fig, 17 Ref.

Descriptors: Hydrodynamics, *Solute transport, *Soil water, *Clays, *Calcium chloride, Fate of pollutants, Unsteady flow, Unsaturated flow, Dissolved solids, Saline water, *Dispersion.

An analytical and conceptual framework is described for exploring hydrodynamic dispersion and reaction in a chemically reactive clay soil during unsaturated, unsteady flow. A 0.1 M calcium chloride solution was applied to a calcium-saturated clay soil with an initially low water content and solution salt concentration. Both parameters preserved similarity in terms of distance divided by the square root of time. The salt front did not coincide with the piston front for the water that might exist if invading water completely displaces the water originally present. This effect was attributed to an immobile water layer on the clay surface about 9 angstroms thick, which was inaccessible to the anion. There appeared to be no restriction on the entry of calcium chloride into the soil when compared with water. A reasonable prediction of solution salt concentration profile was obtained using material coordinates and a constant dispersion coefficient if the inaccesible water layer was considered. (Cassar-FRC)
W83-03001

BACTERIAL UTILIZATION OF SIMPLE ALCOHOLS AND THEIR INFLUENCE ON SATURATED HYDRAULIC CONDUCTIVITY,
Iowa State Univ., Ames. Dept. of Agronomy.
W. T. Frankenberger, Jr, and F. R. Troeh.
Soil Science Society of America Journal, Vol 46, No 3, p 535-538, May/June, 1982. 1 Fig, 5 Tab, 14 Ref.

Descriptors: *Hydraulic conductivity, *Porosity, *Bacteria, Organic compounds, *Methanol, *Propanol, Soil porosity, Microorganisms, Enzymes, Phosphatase, Leaching, Soil physical properties.

Saturated hydraulic conductivities of two cropland soils were significantly reduced by the presence of methanol or n-propanol. Laboratory soil columns containing a Nicollet loam or a Tama silty clay loam were leached for 2000 hours with distilled water, 500 ppm methanol in water, or 500 ppm n-propanol in water. The saturated hydraulic conductivity decreased logarithmically with time until constant values were obtained at about 1500 hours. The mean hydraulic conductivities (cm per hour) after 1500 hours were: Tama soil-distilled water, 2.65; methanol, 0.09; and n-propanol, 0.40; Nicollet soil-distilled water, 4.02; methanol, 0.21; and n-propanol, 0.56. The initial decreases in saturated hydraulic conductivities were a result of structural breakdown of the soil aggregates and expansion of clays; the later decreases were probably related to microbial action in which soil pores became clogged with biological matter. pH values of effluents after 2000 hours leaching were lower for all 3 treatments, with distilled water showing the greatest change. Phosphatase activity was greatest in the oxidized zone (surface) of the columns in decreasing order: methanol > n-propanol > distilled water. As phosphatase activity increased, saturated hydraulic conductivity decreased. (Cassar-FRC)
W83-03014

INFILTRATION AS AFFECTED BY LONG-TERM USE OF SODIC-SALINE WATER FOR IRRIGATION,
Agricultural Research Organization, Bet-Dagan (Israel). Div. of Soil Physics.
For primary bibliographic entry see Field 3C.
W83-03016

THE EFFECT OF TURFGRASS THATCH ON WATER INFILTRATION RATES,
Minnesota Univ., St. Paul. Dept. of Horticultural Science and Landscape Architecture.
For primary bibliographic entry see Field 4A.
W83-03023

SOIL PORE STRUCTURAL STABILITY AND IRRIGATION WATER QUALITY: III. EVALUATION OF SOIL STABILITY AND CROP YIELD IN RELATION TO SALINITY AND SODICITY,
Natal Univ., Pietermaritzburg (South Africa). Dept. of Soil Science and Agrometeorology.
A. Cass, and M. E. Sumner.
Soil Science Society of America Journal, Vol 46, No 3, p 513-517, May/June, 1982. 5 Fig, 1 Tab, 7 Ref.

Descriptors: *Soil stability, *Irrigation water, *Saline water, Water pollution effects, Sodium stability model, Soil structure, Crop yield, Water quality, Soil porosity, Porosity, Soil properties, Hydraulic conductivity.

The relationship between irrigation water quality and soil structural stability is described by a model. A family of threshold concentration curves is determined empirically for each soil. After the variation in composition and concentration of soil water is estimated as a function of rainfall, evapotranspiration, and soil drainage, the quantitative soil stability index is obtained by intersection of the sodium stability curve with the irrigation water-soil solution rectangle. This evaluation is based on a stability index from zero (irrigation water will cause breakdown in soil pore structure) to unity (no structural deterioration likely). Crop response (yield index) to salinity can be evaluated in a similar manner. Both soil stability index and yield index were quantitatively determined for 4 irrigation waters (EC 7.7-191.4 mS per m), 4 soil waters (EC 55-2900 mS per m), 4 soils, 3 crops. (Cassar-FRC)
W83-03025

SOIL PORE STRUCTURAL STABILITY AND IRRIGATION WATER QUALITY: II. SODIUM STABILITY DATA,
Natal Univ., Pietermaritzburg (South Africa). Dept. of Soil Science and Agrometeorology.
A. Cass, and M. E. Sumner.
Soil Science Society of America Journal, Vol 46, No 3, p 507-512, May/June, 1982. 4 Fig, 4 Tab, 30 Ref.

Descriptors: *Soil stability, *Irrigation water, *Saline water, Water pollution effects, Soil structure, Sodium stability model, Soil porosity, Porosity, Clays, Hydraulic conductivity, Soil properties, Water quality, *South Africa.

The effect of mixed Na/Ca solutions on hydraulic conductivity of 20 soils from the South African arid region was studied at fixed sodium absorption values and cation concentrations of 1 to 800 meq per liter. Water uptake (macroscopic swelling) of extracted soil clays was investigated using the same solutions. Na sensitivity and threshold swelling models were computed. The slope of the Na sensitivity model was related to the smectite content, cation exchange capacity, and specific surface of pedal, nonvertisol soils. It was also related to swelling by a log-linear relationship. Some vertisols did not obey these relationships because flowbed geometry was altered during swelling, producing higher hydraulic conductivities than expected from the soil properties. Apedal soils with large amounts of smectite were also more stable than expected because of the stabilizing effects of sesquioxides on clay swelling. Soils most stable in the presence of Na/Ca solutions have low specific surface, low cation exchange capacity, and little smectite and/or sufficient sesquioxide to inhibit swelling. (Cassar-FRC)
W83-03026

SOIL PORE STRUCTURAL STABILITY AND IRRIGATION WATER QUALITY: I. EMPIRICAL SODIUM STABILITY MODEL,
Natal Univ., Pietermaritzburg (South Africa). Dept. of Soil Science and Agrometeorology.
A. Cass, and M. E. Sumner.
Soil Science Society of America Journal, Vol 46, No 3, p 503-506, May/June, 1982. 7 Fig, 16 Ref.

Descriptors: *Soil stability, *Saline water, *Irrigation water, Soil porosity, Soil structure, Water pollution effects, Clays, Hydraulic conductivity, Sodium stability model, Porosity, Model studies, Soil properties, Water quality.

A relationship, the sodium stability curve, provides a basis for evaluating soil aggregate stability. For each soil it provides a slope (resistance of the soil to hydraulic conductiyity reductions in general) and an intercept (sensitivity of soil pore structure to changes in solution concentration and composition). This concept may also be applied to the swelling properties of soils or extracted soil clays (macroscopic swelling in response to a decrease in cation concentration at selected sodium absorption ratios). (Cassar-FRC)
W83-03027

A NUMERICAL STUDY OF RAINDROP IMPACT PHENOMENA: THE RIGID CASE,
Purdue Univ., Lafayette, IN. Dept. of Agronomy.
For primary bibliographic entry see Field 2J.
W83-03029

WATER QUALITY MODELING OF THE EQUUS BEDS AQUIFER IN SOUTH CENTRAL KANSAS,
Kansas Water Resources Research Inst., Manhattan.
For primary bibliographic entry see Field 5B.
W83-03042

TRANSPORT OF WATER IN FROZEN SOIL: I. EXPERIMENTAL DETERMINATION OF SOIL-WATER DIFFUSIVITY UNDER ISOTHERMAL CONDITIONS,
Cold Regions Research and Engineering Lab., Hanover, NH.
For primary bibliographic entry see Field 2C.
W83-03054

MODELING DIRECT RECHARGE OF SURFICIAL AQUIFERS,
Minnesota Univ., St. Paul. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 2F.
W83-03101

SOIL MOISTURE VARIATION PATTERNS OBSERVED IN HAND COUNTY, SOUTH DAKOTA,
National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center.
M. Owe, E. B. Jones, and T. J. Schmugge.
Water Resources Bulletin, Vol 18, No 6, p 949-954, December, 1982. 3 Fig, 5 Tab, 8 Ref.

Descriptors: *Remote sensing, *Soil water, *Sampling, Spatial variation, *South Dakota, Variation coefficient.

Soil moisture data were collected nine times during 1976-78 at a South Dakota test site as part of the ground truth used in an aircraft microwave sensing experiment. Samples were taken over three surface depths (0-2.5, 0-5, and 0-10 cm) at each point. Results, reported as mean field moisture content in each horizon, elucidated the relationship between ground sampling and remote sensing. In areas of varying soil and cover conditions it is advisable to separate data of well-drained sites from poorly-drained sites. The moisture coefficient of variation in a field decreased as the mean field soil moisture increased. The standard deviation was at a maximum in the 15-25% range of moisture conditions. The sample variation decreased as the sample was integrated over a greater depth. It was determined that 10 samples per km was an adequate sampling intensity for characterizing the mean field soil moisture at all three depths along a transect in areas of moderate to good drainage. (Cassar-FRC)
W83-03138

2H. Lakes

CHANGES IN ABUNDANCE AND GROWTH CHARACTERISTICS OF WHITE PERCH FROM THE MOUTH OF THE BAY OF QUINTE,
Ontario Hydro, Toronto. Research Div.
For primary bibliographic entry see Field 6G.
W83-02808

FOOD OF FRESHWATER DRUM IN WESTERN LAKE ERIE,
Fish and Wildlife Service, Sandusky, OH. Biological Station.
M. T. Bur.
Journal of Great Lakes Research, Vol 8, No 4, p 672-675, 1982. 1 Fig, 3 Tab, 13 Ref.

Descriptors: *Fish food organisms, *Invertebrates, *Food habits, *Drum, *Lake Erie, Macroinvertebrates, Benthic fauna, Ecosystems, Cladocerans, Midges, Selectivity, Predation, Zooplankton, Fish diets.

Planktonic cladocerans and larval midges are the primary food organisms of freshwater drum (Aplodinotus grunniens) according to an analysis of drum digestive tracts and samples of macrobenthos in western Lake Erie. Fish less than 1 year old ate mostly cladocerans (87% by volume). Yearlings ate mostly dipterans, while older fish ate both cladocerans and midge larvae. Drum $>$ 250 mm in length also consumed decapods, pelecypods, fish and fish eggs. After the yearling stage, as fish length increased, the proportion of diptera in the diet decreased and the proportion of cladocerans and fish increased. Although oligochaetes and ephippial stages of cladocerans were the most abundant food organisms in the sediments, they constituted $<$ 1% by volume of the drum's diet. The Ivlev index of electivity was positive for diptera at all stations (0.614-0.951) and positive for nematodes at 2 of 9 stations (0.839-0.709). All other benthic food organisms had negative indexes of electivity. (Cassar-FRC)
W83-02810

AN ECONOMIC ANALYSIS OF INTEGRATED FISHERIES MANAGEMENT: THE CASE OF THE LAKE MICHIGAN ALEWIFE AND SALMONID FISHERIES,
Hawaii Univ., Honolulu. Dept. of Agricultural and Resource Economics.
For primary bibliographic entry see Field 6B.
W83-02811

VERTICAL DISTRIBUTION OF PROFUNDAL BENTHOS IN LAKE SUPERIOR SEDIMENTS,
Normandale Community Coll., Bloomington, MN.
A. S. Heuschele.
Journal of Great Lakes Research, Vol 8, No 4, p 603-613, 1982. 4 Fig, 3 Tab, 18 Ref.

Descriptors: *Benthic fauna, *Sediments, *Distribution, Invertebrates, Pontoporeia, Oligochaetes, Amphipods, Tubificids, Nematodes, *Lake sediments, Bottom sediments, Profundal sediments, Fate of pollutants, *Lake Superior, Species distribution, Vertical distribution, Mixing.

The density of benthic organisms in box core sediments collected at 10 open lake sites in Lake Superior, July 1978 and June-July 1979, ranged from 782 to 7142 organisms per sq m (average, 3055 per sq m). Water depths varied from 48 to 265 m. Bottom fauna were distributed from the water-sediment interface to a depth of 1.7 cm in firm

glacial till to a depth of 15 cm in soft clay. Oligochaetes and nematodes penetrated further into loose sediments than into compacted sediments. 96% of the benthic organisms were found within the upper 4 cm of sediment, 47% within the upper 0.5 cm (Pontoporeiahoyi, naidids, sphaeriids, copepods, ostracods, and neorhabdocoels) and 49% at the 0.54-4 cm level (nematodes and oligochaetes). 4% were found below 4 cm. For enchytraeids the vertical distribution of oligochaete cocoons was generally similar to that of adults. Cocoons of lumbriculids and tubificids were usually found at higher levels than the adults, possibly as a result of downward migration at the time of sampling. The rapid biological mixing, particularly by Pontoporeia, that takes place in the sediments can effect the movement of pollutants in the sediment and in the food chain. The benthic fauna can keep pollutants available for circulation by resuspension and incorporation into the food chain or remove them by mixing into deeper layers. (Cassar-FRC)
W83-02822

RETENTION OF BENTHIC INVERTEBRATES WITH DIFFERENT SIEVING TECHNIQUES,
Normandale Community Coll., Bloomington, MN.
A. S. Heuschele.
Journal of Great Lakes Research, Vol 8, No 4, p 619-622, 1982. 2 Tab, 9 Ref.

Descriptors: *Benthic fauna, *Sediments, Sampling, *Sieve analysis, Invertebrates, Pontoporeia, Oligochates, Nematodes, *Lake sediments, *Bottom sediments.

Two techniques of washing lake bottom sediment samples produced statistically different numbers of organisms. Sediment in a 250 micron mesh sieve was: (1) washed with a lake water spray from a hose or (2) agitated in a tub of lake water. Method (1) produced 9.8 more nematodes, 8.0 times more enchytraeids, and 11.7 times more naidids than Method (2). Numbers of lumbriculid oligochaetes, Pontoporeia, and fourth instar chironomid larvae were similar for both techniques. Longer sieving times favored the escape of small organisms, especially of the contractile type, producing lower counts. (Cassar-FRC)
W83-02825

TRENDS IN LAKE ONTARIO SURVEILLANCE PARAMETERS, 1974-1980,
Canada Centre for Inland Waters, Burlington (Ontario).
R. E. Kwiatkowski.
Journal of Great Lakes Research, Vol 8, No 4, p 648-659, 1982. 7 Fig, 2 Tab, 52 Ref.

Descriptors: *Water quality, *Monitoring, Great Lakes, *Lake Ontario, Lakes, Phosphorus, Chlorophyll, Organic carbon, Chlorides, Temperature, Sampling, Trend analysis, Statistical analysis, Seasonal variation, *Pollutant identificaiton, Data collections.

Water quality data obtained during 66 cruises and from 95 stations on Lake Ontario between 1974 and 1980 were subjected to trend analysis. There were statistically significant decreases in total phosphorus, chlorophyll a, and particulate organic carbon duuring this period. Seasonally corrected trend-in-time equations were formulated for the 17 zones of interest to the International Joint Commission for temperature, total phosphorus, chlorophyll a, particulate organic carbon, and chlorides. Results indicated that water quality in offshore areas has been more stable than in nearshore areas. Although the equations cannot accurately predict abrupt or major changes in the data, they can be useful in identifying local deviations from historical data in the various zones, and seasons. (Cassar-FRC)
W83-02840

WAVE ACTION AND BOTTOM SHEAR STRESSES IN LAKE ERIE,
California Univ., Santa Barbara. Dept. of Mechanical and Environmental Engineering.
S. W. Kang, Y. P. Sheng, and W. Lick.
Journal of Great Lakes Research, Vol 8, No 3, p 482-494, 1982. 8 Fig, 28 Ref.

Descriptors: *Lakes, *Waves, *Shear stress, Bottom water, Stress, Sedimentation, Wind, Wind waves, *Lake Erie.

The amplitudes and periods of wind-driven, surface gravity waves were calculated by means of the SMB hindcasting method for Lake Erie. Bottom orbital velocities and bottom shear stresses were then calculated using linear wave theory and Kajiura's turbulent oscillating boundary layer analysis. These calculations were made for south-west and north wind directions and a steady wind speed of 40 km/hr. Calcuated bottom shear stresses are related to the textural properties of surficial Lake Erie sediments as determined by Thomas. The bottom shear stresses, especially under prevailing southwest wind conditions, control the textural characteristics of surface sediments in Lake Erie. In particular, wave-induced bottom shear stresses are probably the most important energy source for sediment entrainment. While these analyses provide some useful preliminary information on wave action and bottom stresses in Lake Erie, several aspects of the problem must be considered further. (Baker-FRC)
W83-03073

LARGE LAKES OF THE WORLD,
Ohio State Univ., Columbus. Center for Lake Erie Area Research.
C. E. Herdendorf.
Journal of Great Lakes Research, Vol 8, No 3, p 378-412, 1982. 9 Fig, 8 Tab, 41 Ref.

Descriptors: *Lakes, *Morphometry, Large lakes, Lake Baikal, Water quality, Limnology, Bathymetry, Lake geography, Glaciers, Mapping.

An inventory was undertaken of th distribution, origin, and morphometry of the world's large lakes. Natural lakes, fresh and salt, with a surface area greater than 500 sq km were included. This numbers 253 known lakes. Large lakes occur on all continents, except Antarctica, but nearly half of them are found in North America and most of these lie above the 40th parallel, attesting to the scoring action of continental glaciers. Tectonic belts, such as the Rift Valley of east Africa and the Lake Baikal region of Siberia, are the second most common loci of large lakes. Tabular morphometric data include surface area, drainage basin, elevation, mean and maximum depth, volume, length and breadth and orientation of longest axis. These data show that the large lakes of the world occupy a surface area of 1,456,000 sq km, and they have an estimated volume of 202,000 cu km. Large lakes account for about 90% of the total surface area and volume of water held in all lakes of the world. (Baker-FRC)
W83-03078

LAKE-WIDE SEASONAL CHANGES IN LIMNOLOGICAL CONDITIONS IN LAKE MICHIGAN IN 1976,
Manhattan Coll., Bronx, NY.
C. R. Bartone, and C. L. Schelske.
Journal of Great Lakes Research, Vol 8, No 3, p 413-427, 1982. 10 Fig, 3 Tab, 33 Ref.

Descriptors: *Lakes, *Limnology, *Lake Michigan, Great Lakes, Algae, Phosphorus, Nutrients, Eutrophication, Chlorophyll, Light intensity, Light penetration.

A synthesis is presented of some of the results obtained from a lake-wide sampling that was conducted as part of a research program on eutrophication processes in Lake Michigan. The average water temperature was cooler and average water transparency was greater in the northern lake than in the southern, but with the exception of total phosphorus, average nutrient concentrations did not differ between the northern and southern parts. It was found that physical-chemical characteristics of nearshore and Straits of Mackinac stations differed significantly from open lake stations. Seasonal phytoplankton dynamics in the open lake were related to seasonal and vertical changes in silica and nitrate nitrogen. The spring phytoplankton bloom occurred before the lake was strongly stratified thermally. After thermal stratification was well developed, epilimnetic concentrations of chlorophyll-a decreased, probably due to some combination of nutrient limitation and zooplankton grazing, and maximum chlorophyll-a concentrations were found below the thermocline. Epilimnetic silica concentrations decreased after thermal stratification, and diatoms were replaced in the phytoplankton assemblage by green and blue-green algae in late summer. Total phosphorus averaged only 8 micrograms/liter on a lake-wide basis, and only small but significant reductions in absolute concentration can be expected from phosphorus control programs. Over a period of years, however, these small reductions may be difficult to verify from total phosphorus measurements, which have relatively large sampling errors and variances. (Baker-FRC)
W83-03079

A TEN-YEAR STUDY OF PHYTOPLANKTON BIOMASS AND COMPOSITION IN THE NANTICOKE REGION OF LONG POINT BAY, LAKE ERIE,
Ontario Ministry of the Environment, Rexdale. Limnology and Toxicity Section.
G. J. Hopkins, and C. Lea.
Journal of Great Lakes Research, Vol 8, No 3, p 428-438, 1982. 5 Fig, 5 Tab, 18 Ref.

Descriptors: *Lakes, *Phytoplankton, Great Lakes, *Lake Erie, Biomass, Long Point Bay, Limnology, Temperature effects, Water quality, Algal growth, Taxonomy.

Changes in abundance, taxonomic composition, and the seasonal succession of phytoplankton have been evaluated at seven stations in the vicinity of Nanticoke, east Long Point Bay, Lake Erie, from 1969 to 1978. Quantitative measurements of phytoplankton were recorded as Areal Standard Units per milliliter. The 10-year mean value was 374 A.S.U. per mL. Annual means over the 10 year period varied from a low of 224 ASU per mL in 1969 to 606 in 1978. Seasonal succession patterns and biomass levels showed fluctuation expressing unimodal, biomodal, and even trimodal peaks from station to station and year to year. A total of 240 taxa were recorded during the study, 35 of which were present during all years. Temperature data collected at the same stations suggested that water was warmed during some years, but followed very closely a normal seasonal curve ranging from 5C in April to 22C in August. No direct or inverse relationship to years in which one or the other parameter deviated from the normal pattern was noted in phytoplankton population. Due to the similarity of the algal community in its year-to-year seasonal development and taxonomic composition, the ten years of data presented should provide a sound data base for future comparisons off nearshore phytoplankton in Lake Erie. (Baker-FRC)
W83-03080

TEN ECOSYSTEM APPROACHES TO THE PLANNING AND MANAGEMENT OF THE GREAT LAKES,
Toronto Univ. (Ontario). Inst. for Environmental Studies.
For primary bibliographic entry see Field 6A.
W83-03082

SORPTION AND SEDIMENTATION OF ZN AND CD BY SESTON IN SOUTHERN LAKE MICHIGAN,
Argonne National Lab., IL.
For primary bibliographic entry see Field 5B.
W83-03083

SOLUBLE REACTIVE PHOSPHORUS MEASUREMENTS IN LAKE MICHIGAN: FILTRATION ARTIFACTS,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
For primary bibliographic entry see Field 5A.
W83-03084

Group 2H—Lakes

DATA FILTERING FOR LARGE AREA ANALYSIS-AN EXAMPLE FROM THE CANADIAN NEARSHORE ZONE OF THE GREAT LAKES,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 7C.
W83-03085

POSSIBLE INFLUENCES UPON LAKE DEVELOPMENT IN THE EAST AFRICAN RIFT VALLEYS,
Massachusetts Univ., Amherst. Dept. of Geology and Geography.
R. F. Yuretich.
Journal of Geology, Vol 90, No 3, p 329-337, 1982. 4 Fig, 2 Tab, 32 Ref.

Descriptors: *Lake morphology, *Geochemistry, *Morphology, *Africa, Lake sediments, Lake basins, Volcanoes, Rift valleys, Geohydrology, Drainage patterns, Evaporites, Chemical composition, Sediments, Geomorphology, Saline lakes.

Volcanism and climate are responsible for determining the hydrological, sedimentological, and geochemical characteristics of lakes in the East African Rift system, which consists of eastern (Ethiopia, Kenya, and Tanzania) and western (Uganda, Zaire, Zambia, Mozambique) arms. In the eastern rift extensive volcanism has disrupted drainage and increased rainfall infiltration, creating small, shallow lake basins occupying only a part of the rift width. Lake waters contain sodium, bicarbonates, and chlorides and are saline and alkaline, with total dissolved solids generally exceeding 1000 mg per liter. Eastern rift lakes often lack surface outlets and have maximum depths of 100 m. Western rift lakes are in a region of localized volcanism. They are large and deep (to 1400 m in Lake Tanganyika) with low dissolved solids, predominantly K, Mg, and sulfate. Influent and effluent rivers are common in the western rift area. Sedimentation rates are 30-50 cm per thousand years in the west and 100-300 cm per thousand years in the east. Smectite is the dominant clay mineral in the east; sediment compositions in the west are less known and more variable. Evaporites also differ in the two regions: sodium zeolites and sodium carbonate in the east and potassium zeolites, gypsum, and Mg in the west. (Cassar-FRC)
W83-03115

2I. Water In Plants

A WATER USE COMPARISON BETWEEN CORN AND SUNFLOWER,
Agricultural Research Service, Morris, MN. North Central Soil Conservation Research Center.
M. J. Lindstrom, D. D. Warnes, and S. D. Evans.
Journal of Soil and Water Conservation, Vol 37, No 6, p 362-364, November/December, 1982. 3 Fig, 2 Tab, 6 Ref.

Descriptors: *Water use, *Drought resistance, *Soil-water-plant relationships, Water consumption, *Corn, *Sunflower, Soil water, Water stress, Minnesota.

Water use of corn (Zea mays L.) and sunflower (Helianthus annus L.), reputedly drought resistant, were similar, as determined in field tests conducted in 1977-79 at Morris, Minnesota. Soil water measurements using the neutron method showed that the accumulative water use values (25-50 cm per season) did not differ by more than 5 cm between the 2 crops in any year. Less soil water was available for sunflower starting in the rapid vegetative growth period preceding the reproductive stage. Corn tended to have a higher water use than sunflower late in the season. The sunflower is susceptible to drought stress only in the 3 weeks from heading to flower completion, whereas corn is drought-susceptible over a longer period, particularly during silking through pollination and during ear filling. (Cassar-FRC)
W83-02828

MIDSEASON SOIL WATER RECHARGE FOR CORN IN THE NORTHWESTERN CORN BELT,
Michigan Agricultural Experiment Station, East Lansing.
For primary bibliographic entry see Field 2G.
W83-02890

COMBINED WATER-FERTILIZER MANAGEMENT TO MINIMIZE NON-POINT WATER POLLUTION WHILE ACHIEVING HIGH CROP PRODUCTION,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
J. Letey, and W. M. Jarrell.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-196691, Price codes: A02 in paper copy, A01 in microfiche.
California Water Resources Center Completion Report, Univ. of California, Davis, April 1983. 17 p, 12 Ref. OWRT B-203-CAL(1).

Descriptors: *Irrigation, *Fertilizers, *Nitrogen, Drip irrigation, Furrow irrigation, Sprinkler irrigation, Irrigation efficiency, Vegetable crops, *California, *Nonpoint pollution sources.

Greenhouse and field experiments were conducted to characterize relationships between fertilizer and water management in irrigated vegetable production in California. Greenhouse trials were conducted both in hydroponic solution culture and in soil culture, with tomatoes and lettuce, to establish functional relationships between nitrogen and water uptake by single plants, and nitrogen recovery efficiency as a function of method and rate of application and placement for simulated drip irrigation system with one fertilizer material, urea-ammonium nitrate. Over a wide range of solution culture nitrogen concentrations, the relationship between nitrogen absorbed and water absorbed by the plant was constant. Slightly more N was taken up by plants where emitters delivered it to the soil surface than where the emitter was placed 2.5 cm below the soil surface; less than 0.1% of the supplied N was recovered in acid traps as volatilized ammonia. Field trials with drip-irrigated tomatoes and celery, furrow-irrigated broccoli, celery, and corn, and sprinkler-irrigated celery and broccoli established relationships between quantity of N applied, method of N application (soil-applied soluble or slow release fertilizers, midseason sidedressing, application through irrigation water), quantity of water applied, and crop yield and nitrogen accumulation. Application of fertilizer in the irrigation was most efficient where no runoff occurred, and where plants grew rapidly. When plants grew slowly due to intermittent drought stress, nitrogen recovery efficiency was lower than where adequate but not excessive quantities of water were applied. Application of fertilizer in the irrigation water must anticipate crop nutrient demand to be effective, and must be placed in the root zone. (Snyder-California)
W83-02907

SALINITY AND BORON CONTROL UNDER HIGH-FREQUENCY LOW-VOLUME IRRIGATION,
California Univ., Davis. Dept. of Land, Air and Water Resources.
For primary bibliographic entry see Field 5B.
W83-02908

SOIL PORE STRUCTURAL STABILITY AND IRRIGATION WATER QUALITY: III. EVALUATION OF SOIL STABILITY AND CROP YIELD IN RELATION TO SALINITY AND SODICITY,
Natal Univ., Pietermaritzburg (South Africa). Dept. of Soil Science and Agrometeorology.
For primary bibliographic entry see Field 2G.
W83-03025

2J. Erosion and Sedimentation

CALCIUM CARBONATE IN POSTGLACIAL LAKE ERIE SEDIMENT,
Canada Centre for Inland Waters, Burlington (Ontario).
A. Mudroch, A. J. Zeman, and L. L. Kalas.
Journal of Great Lakes Research, Vol 8, No 4, p 711-718, 1982. 7 Fig, 1 Tab, 14 Ref.

Descriptors: *Lake sediments, *Sediments, *Calcite, Bottom sediments, Geochemistry, Mineralogy, *Lake Erie, Climatology, Carbonates, Calcium carbonate.

A 16.8 m long postglacial sediment core collected from the central Lake Erie basin contained two zones of high calcium oxide and strontium concentrations at about 9-13 m and 15.5 m depths. These zones, containing up to 30% calcite, were associated with a very fine sediment, 80% of which was < 4 microns. The calcite depositions reflected two major climatic temperature increases of up to 10C, which occurred 13,000-12,000 years and 10,000-8,000 years B.P. Shear strength values of the sediments ranged from 2 kN per sq m near the lake sediment-water interface to 9 kN per sq m at the 14-16.8 m depth (the Pleistocene boundary). Concentrations of Si02, A1203, Fe203, K20, and Rb gradually decreased with depth. Illite was the most abundant crystalline phase, followed by chlorite, calcite, quartz, albite, potassium feldspar, and dolomite. Examination of mollusk shells in the sediment core showed that the sediments high in carbonate were deposited in warmer water than the sediments low in carbonate. (Cassar-FRC)
W83-02809

RUNOFF AND SOIL EROSION ON FROZEN SOILS IN NORTHEASTERN OREGON,
Agricultural Research Service, Pendleton, OR. Columbia Plateau Conservation Research Center.
J. F. Zuzel, R. R. Allmaras, and R. Greenwalt.
Journal of Soil and Water Conservation, Vol 37, No 6, p 351-354, November/December, 1982. 4 Fig, 3 Tab, 21 Ref.

Descriptors: *Soil erosion,*Frozen ground, *Snowmelt, Sediment tranpsort, Erosion, Runoff, Rainfall-runoff relationships, *Oregon, Infiltration, Soil loss.

Frozen soils, snowmelt, and rainon snow were key mechanisms in the major soil loss events recorded during the winter of 1979-80 at 4 monitoring sites in northcentral Oregon. Test sites represented conventionally tilled and planted fields in a wheat-fallow rotation. The 14 erosion-producing runoff events were associated with frozen soils, 2 with rain only and 12 with snowmelt or rain on snow. As much as 87% of precipitation ran off. Soil losses (tons per ha) were 0.5, 1.1, 29.0, and 31.0 at the 4 sites from January 12 to February 25, 1980. Precipitation intensity was not a major cause of runoff and erosion because most of the rain fell on snow. Large quantities of heat of vaporization were liberated at the snow-air interface by the high dewpoint temperature caused by warm, moist Pacific air masses. This produced a faster snowmelt than expected from sensible heat, radiation, and the heat content of rain. Condensation melt in a typical rain-on-snow event accounted for as much as 38% of total hourly melt and averaged 21% for the entire event. These results indicate that the Universal Soil Loss Equation applied to this region should be corrected for the effects of frozen soil and runoff. (Cassar-FRC)
W83-02826

HYDROLOGY, HYDRAULICS, AND SEDIMENT TRANSPORT, KANKAKEE AND IROQUOIS RIVERS,
Illinois State Water Survey Div., Champaign.
M. Demissie, N. G. Bhowmik, and J. R. Adams.
Report of Investigation 103, 1983. 66 p, 30 Fig, 11 Tab, 22 Ref.

Descriptors: *Hydrology, *Hydraulics, *Sediment transport, *River basins, *River flow, Sediment discharge, Flow discharge, Flow characteristics, Flood routing, Flood control, Storm water, Water surface profiles, Channel flow, Computer programs, *Illinois, Kankakee River, Iroquois River, Indiana.

The Kankakee is an important resource for both Illinois and Indiana and any alteration of the hydrology or hydraulics of the upstream portion of

the river will have a significant impact on the river system in either state. The sediment transport characteristics of the rivers were studied based on three years of suspended sediment data at four gaging stations. Reflecting the combined flows of the upper Kankakee and the Iroquois, the Kankakee near Wilmington is strongly influenced by the Iroquois during flood flows and the upper Kankakee during low flows. Wetlands on the Kankakee, and the differences in geology, drainage area shape, and stream slope are the main reasons for the different flow characteristics between the two rivers. Sandy soils and wetlands in the upper Kankakee Basin also provide underground and surface water storage, thereby reducing peak flows during floods and increasing low flows during dry periods. Sediment transport rating curves, relating daily sediment discharge to average daily water discharge, were developed. The impact of storm episodes was also analyzed at the four stations, and it was found that 50% of the annual sediment load in 1980 moved past three stations in only four to six days. A hydraulic analysis of the Iroquois studied the impacts of channel clearing and snagging using tow computer programs to calculate water surface profiles and to route floods. The results showed decreased water surface elevations and an increase in velocity which will increase bank erosion and, subsequently, total sediment load in the channel. The potential for more frequent flooding also increases. (Atkins-Omniplan)
W83-02921

EFFECTS OF AGGRADATION AND DEGRADATION ON RIFFLE-POOL MORPHOLOGY IN NATURAL GRAVEL CHANNELS, NORTHWESTERN CALIFORNIA,
Pacific Southwest Forest and Range Experiment Station, Arcata, CA.
T. E. Lisle.
Water Resources Research, Vol 18, No 6, p 1643-1651, December, 1982. 4 Fig, 3 Tab, 35 Ref.

Descriptors: *Channel morphology, *Sediment transport, *Aggradation, Gravel, Aquatic habitats, Habitats, Riffles, Bed load, Stream degradation, Floods, *California, Stream erosion, Stream fisheries, Stream gradient, Degradation, Erosion, Thalweg.

In December 1964 a severe flood and overwhelming sediment load in Northern California streams decreased bar roughness and diminished the contrasts in the riffle-pool sequences. Some of the 12 reaches studied widened as much as 100% and aggraded as much as 4 m, then degraded to stable levels over the next 5 or more years. The aggraded channels had finer bed material and shallower, faster, steeper flow at low to moderate flow. Bar height and pool depth decreased, and riffles eroded headward. The abundant sediment supply and the channel morphology caused increased bed load transport at relatively low discharges. As the sediment supply decreased these processes were reversed. Some channels will not recover until the sediment supply and erosion are further reduced. (Cassar-FRC)
W83-02936

SETTLING VELOCITY OF NATURAL PARTICLES,
Washington Univ., Seattle. Dept. of Geological Sciences.
W. E. Dietrich.
Water Resources Research, Vol 18, No 6, p 1615-1626, December, 1982. 10 Fig, 6 Tab, 35 Ref.

Descriptors: *Settling velocity, *Sedimentation, Particle shape, Particle size, Shape, Density.

An empirical equation was developed to describe the effects of size, density, shape, and roundness on settling velocity of natural sediments. Data from 14 previous experimental studies were used as a basis. The analysis was done in terms of 4 nondimensional parameters: dimensionless nominal diameter (D), dimensionless settling velocity, the Corey shape factor, and the Powers roundness factor. For high D (large or dense particles) changes in roundness and shape factor produced effects of similar magnitude on settling velocity. Roundness varied much less for natural grains and was less important than shape in control of settling velocity. For a typical coarse sand (Powers roundness of 3.5 and Corey shape factor of 0.7) the settling velocity was 0.68 that of a perfect sphere of the same D. Shape and roundness contributed equally to this reduction in settling velocity. At low D, the effects of roundness and shape were much less. Low roundness caused a greater decrease in settling velocity at low shape factor values than at high shape factor values. This appeared to be a result of increased surface drag on flatter grains. (Cassar-FRC)
W83-02939

EROSION OF BANKS ALONG PIEDMONT URBAN STREAMS,
North Carolina Univ. at Charlotte. Dept. of Geography and Earth Sciences.
M. P. Wilson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-206292, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Institute Report No 189, North Carolina State Univ., Raleigh, February 1983. 38 p, 14 Fig, 1 Tab, 23 Ref. OWRT A-113-NC(1), 14-34-0001-0135.

Descriptors: *Stream erosion, *Erosion, *Bank erosion, *Stream banks, Banks, Urban drainage, Slope degradation, Urban areas, North Carolina, Piedmont streams.

Urbanized and non-urbanized tributary streams of the Piedmont are usually cut into post-European reddish sands and pre-European-settlement gray cohesive soils. These streams are eroding by scour and bank failure. Currently, berms (or inner-channel terraces) are a common product of bank failure; otherwise inner-channel deposition is rare and consists of point bars formed as meanders begin to develop. The cohesive sediments are more scour resistant than the sandy sediments. Bank failure is of the slab type, and is a normal part of the erosion process. Traditional design approaches have failed to create stable channels, primarily because (1) we do not understand erosive processes in cohesive sediment, and (2) urban environments require abnormally narrow channels. Erosion in channels less than about twelve feet deep can be reduced significantly by consideration of natural fluvial processes, artificial berm development, and judicious use of rip-rap. Torvane strength, color, composition and particle size distribution readily characterize bank materials and their erodibility.
W83-02945

DAM AND RIVER SAND-DRIFTING INSPECTION (LA BATHYMETRIE--TECHNIQUE DE SURVEILLANCE DE L'ENSABLEMENT DES FLEUVES ET DES RETENUES),
Travaux Sous-Marins, Peney (Switzerland).
P. Martin.
Wasser, Energie, Luft, Vol 73, No 10, p 218-220, October, 1981. 7 Fig. English summary.

Descriptors: *Bathymetry, *Sand, *Bottomm sediments, Hydroelectric plants, Sounding, Water depth, Siltation, Sedimentation, Power plants, Dams, Lessoc, *Switzerland, Reservoir silting.

Precision bathymetric techniques permit the observation of the evolution of sand drifts in a relieving tackle. Comparisons of echo-sounding recordings show, season after season and year after year, all the variations in bottom depths and contours. This allows identification of the location of accumulation zones and calculation of the volume of the sediments deposited around the water gates of dams. Inspection of these mechanisms enables draining off and cleansing of the relieving tackle. Both the equipment and the technique used to draw a sea-chart are described, and the application of this technique to hydroelectric power plants is discussed. The inspection of sand drifts at the Lessoc water power plant of the 'Enterprises Electriques Fribourgeoises' is used to demonstrate the usefulness of this procedure. (Author's abstract)
W83-02961

EFFECTS OF A FLOODWATER-RETARDING STRUCTURE ON THE HYDROLOGY AND ECOLOGY OF TROUT CREEK IN SOUTHWESTERN WISCONSIN.
Geological Survey, Madison, WI. Water Resources Div.
For primary bibliographic entry see Field 6G.
W83-02985

A NUMERICAL STUDY OF RAINDROP IMPACT PHENOMENA: THE RIGID CASE,
Purdue Univ., Lafayette, IN. Dept. of Agronomy.
C. Huang, J. M. Bradford, and J. H. Cushman.
Soil Science Society of America Journal, Vol 46, No 1, p 14-19, January/February, 1982. 11 Fig, 16 Ref.

Descriptors: *Erosion, *Rainfall impact, *Soil erosion, Marker-Cell method, Soil Strength.

The impact of spherical raindrops on a rigid surface was studied using the Marker and Cell numerical technique. Results showed that impact pressures were very high (1050-1200 kPa) at the instant of impact and diminished to 200 kPa, about 5 times the steady-state stagnation pressure, after 5 microseconds. Maximum pressure was at the circumference of the water drop contact surface. The pressure gradient within the drop decreased very quickly. The lateral jetting velocity was twice the impact velocity. This high velocity lateral jet stream is probably the crucial mechanism in detachment of soil by raindrops. Three critical factors are important in defining resistance against raindrop impact: soil deformation characteristics, soil shearing strength, and surface microrelief. (Cassar-FRC)
W83-03029

SEDIMENT TRANSPORT IN ALLUVIAL CHANNELS: RATES FOR EROSION AND DEPOSITION OF COHESIVE SEDIMENTS LITERATURE REVIEW AND EXPERIMENTAL DESIGN,
Oklahoma State Univ., Stillwater. Dept. of Chemical Engineering.
J. Wagner, and S. -P. Kuan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-206797. Oklahoma Water Resources Research Institute Completion Report, Oklahoma State Univ., Stillwater, March 1983. 65 p, 6 Fig, 1 Tab, 144 Ref. 1 Append. OWRT A-094-OKLA(2), 14-34-0001-1138.

Descriptors: *Erosion rates, *Experimental design, *Open channels, *Sedimentation rates, *Test facilities, Alluvial channels, Channel erosion, Deposition, Fabrication, Flumes, Hydraulic transportation, Open-channel flow, Pumps, Sediment erosion, *Sediment transport, Sediments, Silting, Soil erosion, Soil properties, Suspended sediments, Tractive forces.

Nationally sediment pollution exceeds all other types including those from municipalities and industries. Sediment is recognized as a dangerous multiple pollutant since it may carry other contaminants such as herbicides, pesticides, tosic metals, and plant nutrients adsorbed on particles surfaces. Evaluation of water quality improvements which might be derived from alternative control techniques will require methodologies for predicting the transport and distribution of sediments and associated contaminants in alluvial channels on agricultural and silvicultural watersheds. The mechanisms of hydraulic erosion and deposition of cohesive sediments are extremely complex and depend not only upon the hydraulic regime, but also upon the physicochemical forces between sediment particles. The strength and number of bonds between particles of cohesive sediment are influenced by the sediment mineralogy, mode of deposition, and the chemical quality of the pore and eroding fluids. A review of the literature has been conducted to describe the progress toward understanding the mechanisms of hydraulic erosion and deposition of cohesive sediments. At the present time there are not methods for predicting rates of erosion or deposition which do not require field or laboratory erosion or deposition studies.

An experimental tilting recirculating flume has been designed to aquire data which can be used in empirical models for rates of erosion and deposition of cohesive sediments. It can be used to develop more detailed mechanistic models. Factors which must be considered in the design of a flume which will handle sediment suspensions are discussed, and guidelines for experimental procedures for erosion and deposition studies are outlined.
W83-03032

EFFECTS OF FARMING PRACTICES ON SEDIMENT IN IRRIGATION RETURN FLOW,
Washington State Univ., Pullman. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 4D.
W83-03039

A STUDY OF THE BED-LOAD YIELD FROM A WATERSHED,
Clemson Univ., SC. Dept. of Civil Engineering.
H. S. Woo, J. S. Fisher, B. L. Sill, and S. Nnaji.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-208561, Price codes: A06 in paper copy, A01 in microfiche. Water Resources Research Institute Publication No 100, Clemson Univ., S. C., March 1983. 97 p, 28 Fig, 17 Tab, 27 Ref, 6 Append. OWRT A-050-SC(1), 14-34-0001-1143 and 0143.

Descriptors: *Sediment yield, *Watersheds, *Bed load yield, *Hydrographs, Sedimentation basins, Sediments, Water, Settling basins, Runoff, Mountains, Rainfall, Storm runoff, North Carolina.

It has been shown that small experimental watersheds are indicative of their respective physiographic regions. It is in this context that Watershed 22 of the Coweeta Hydrologic Laboratory, North Carolina encompassing an area of 356,000 m super 2, was chosen for studies pertaining to bed-load yields. Sediment samples were taken by diverting stream flow around the gaged stilling basin at the base of the watershed draining the basin, and physically removing the sediment. The sample was transported to the Clemson Hydraulics Laboratory for analysis. Sediment yields for seven collection periods varied from 3.8 kg to 78.2 kg. Elapsed time between samples varied from 5 days to 34 days. A satisfactory predictive bed-load equation was obtained by dividing the hydrograph into base flow and run-off volumes. The run-off volume was normalized by the number of days elapsed. The resulting run-off sediment yield equation is K(kg) = 6.65 x 10 super -3 (V sub R)1.19 with V sub R the normalized runoff volume in m super 3/day. This is a useful result in that it enables the prediction of sediment yields from any area with similar forest cover conditions no matter what the stage of a stream at the time of study. To test the efficiency of the sediment collecting methods described in this report, the sediment data were compared with the results of a study conducted at another watershed within the same locality. The results were shown to be quite accurate.
W83-03096

MOBILIZATION, MOVEMENT AND DEPOSITION OF ACTIVE SUBAERIAL SEDIMENT FLOWS, MATANUSKA GLACIER, ALASKA,
Cold Regions Research and Engineering Lab., Hanover, NH.
D. E. Lawson.
Journal of Geology, Vol 90, No 3, p 279-300, 1982. 13 Fig, 1 Tab, 49 Ref.

Descriptors: *Glacial sediments, *Sediment transport, *Ice, Matanuska Glacier, *Alaska, Till, Diamicton, Deposition, Melting, Fluid flow, Shear, Sediment-Carrying capacity.

Subaerial sediment flows, which deposit diamictons at the terminus of Matanuska Glacier, Alaska, were investigated during 1974-79. The flows originate where sediments overlie glacier ice. Ablation of ice on slopes releases the sediment and mixes it with melt water and debris. Sediment begins to flow as a result of excess pore pressures and seepage pressures produced by melt water. Sediment flows vary widely in dimensions, texture, flow rates, density, erosional action, grain support, and transport mechanisms which depend on changes in water content of the material. At low water contents, flows support grains by their strength and move through shear in a thin zone at their base. Increased water content increases the thickness of the shear zone and produces deformations such as grain interference and collisions, localized liquefaction and fluidization, transient turbulence, and bed-load traction. Flows with maximum water content are fully liquified and well-mixed. Mobilization of a sediment flow changes the glacial sedimentary properties of its source. Therefore, the diamicton deposited by sediment flow should not be called till. (Cassar-FRC)
W83-03116

SOURCES, SINKS, AND STORAGE OF RIVER SEDIMENT IN THE ATLANTIC DRAINAGE OF THE UNITED STATES,
Geological Survey, Denver, CO.
R. H. Meade.
Journal of Geology, Vol 90, No 3, p 235-252, 1982. 12 Fig, 3 Tab, 72 Ref.

Descriptors: *Sediment transport, *River basins, *Erosion rates, Fate of pollutants, *Atlantic coast, Sediment discharge, Sediment erosion, Sediment load, Sediment yield, Reviews, Streamflow, Storage, Soil erosion, Reservoir silting, Silting, Flood plains, Marshes, Estuaries, Agriculture, Coastal marshes, Coastal plains, *Coastal streams, Suspended sediment.

Difficulties in modeling sediment on a river basin scale are shown in a review of sediment and its movement in Atlantic drainage rivers. Sediment-streamflow relationships vary widely during seasons and among rivers. Highest sediment concentrations and yields are in southern Piedmont rivers; lowest concentrations and yields are in southern Coastal Plain rivers. In many rivers half the sediment is discharged in 1% of the time and 85-95% of the sediment in 10% of the time. This shows that a given sediment particle spends much time in storage and very little time in transport. On a millennial scale soil erosion is the original source of river sediments. The erosion rate increased dramatically in the 17th century as European settlers cleared forests and started farming. Erosion has been most severe in the lower Piedmont of South Carolina and Georgia. Improved soil conservation practices and a decrease in cropland area have decreased erosion rates. However, so much sediment is in storage in rivers, reservoirs, flood plains, and hillslopes that river sediment loads have not decreased. It is estimated that a century or more will be required to clear valley bottoms of excess sediment. Sediments stored further from the river may take much longer to move through the system. For example, most of the hydraulic mining debris on the Sacramento River flood plain remains where it was deposited 100 years ago. Reservoirs that hold a tenth of the annual water flow can trap 80-90% of inflowing sediment. Severe floods can release large amounts of sediment. Channels below reservoir experience accelerated erosion. The ultimate sinks for river sediments and associated contaminants in the Atlantic drainage are the estuaries and marshlands. Only 5% of the sediment load reaches the continental shelf or deep sea. (Cassar-FRC)
W83-03117

TURBIDITY IN THE WESTERN BASIN OF LAKE ERIE,
Environmental Protection Agency, Narragansett, RI.
J. F. Paul, R. Kasprzyk, and W. Lick.
Journal of Geophysical Research, Vol 87, No C8, p 5779-5784, July 20, 1982. 9 Fig, 1 Tab, 15 Ref.

Descriptors: *Turbidity, *Lake sediments, *Sediment transport, Fate of pollutants, Intakes, *Lake Erie, Maumee River, *Ohio, Water supply, Suspended sediment, Suspended solids, Wave action, Shear stress, Bottom sediments.

A formula for describing turbidity as a function of bottom shear stress due to wave action and sediment loading from a river was developed using data from the Oregon, Ohio, municipal water intake, located near the Maumee River outlet in Lake Erie's western basin. Excellent agreement was obtained between observed and calculated turbidities for 1977 (the year used to determine the coefficients) and 1976, 1978, and 1979. Results show that turbidity is directly related to wave action and the resulting bottom stress. Turbidity is not closely related to wind magnitude or wind direction. Sediments from the Maumee River significantly contribute to the amount of entrainable sediment near the intake. Sediment loadings, highest in spring, show a highly seasonal variation. High turbidity is produced by the transport of suspended solids from the Maumee River to the intake. There is a reasonable equality between turbidity in NTU units and suspended sediment concentrations in units of mg per liter. (Cassar-FRC)
W83-03118

SEDIMENTATION AND ITS CONTROL IN NADIS IN THE INDIAN ARID ZONE - A CASE STUDY,
Central Arid Zone Research Inst., Jodhpur (India).
K. D. Sharma, and D. C. Joshi.
Journal of Arid Environments, Vol 5, No 3, p 269-276, 1982. 5 Tab, 5 Ref.

Descriptors: *Sedimentation, *Arid zones, *Vegetation, Sediment transport, Rainfall, Erosion control, Sand, Alluvial deposits, Nadis, *India, Storage capacity, Storage reservoirs, Water storage.

Sandy and eroded rocky catchments in association with torrential rainfall are the main causes of heavy sediment deposition in nadis (small water storage structures) and markedly reduce their capacity. A study was made of 117 nadi samples, selected by a stratified random sampling technique. Sediments in nadis occurring in the sandy plain environment were mainly composed of 49.2-81.3% fine to very fine sand, 4.4-19.7% silt and 9.5-23.5% clay. In nadis non-vegetated catchments, the sediment yield and sediment production rate increases sharply with the rainfall and slope groups. Dunes in the region are stabilized with intermittently exposed older alluvium. Therefore the sand fraction is prevented from being carried away with the runoff, and thus the sediments contain a higher proportion of silt and clay and less sand than the sandy plain catchments under the same rainfall zone. Younger alluvial deposits in this area are assemblages of a variety of coarse to fine textured soils and occur along the banks of ephemeral channels and in depressions. The sediment deposited in the nadis in this setting consists of 52.9-77.8% coarse to fine sand, 4.8-11.9% silt and 7.0-26.7% clay and a slightly higher proportion of gravels than in the sandy plain catchments. The older alluvial formations in this region are composed of coarse to medium sand, gravels and grit cemented with secondary calcium carbonate. It was evident from the study that sediment in the sandy plain, dune complex, younger and older alluvial settings can be reduced significantly by introducing vegetation in the catchments. (Baker-FRC)
W83-03133

RUNOFF AND WATER QUALITY FROM THREE SOIL LANDFORM UNITS ON MANCOS SHALE,
Bureau of Land Management, Denver, CO. Div. of Special Studies.
W. L. Jackson, and R. P. Julander.
Water Resources Bulletin, Vol 18, No 6, p 995-1001, December, 1982. 7 Fig, 4 Tab, 10 Ref.

Descriptors: *Sediment transport, *Erosion, *Saline water, Sediment concentration, Sediment control, Sediment load, Sedimentary rocks, Mancos shale, Shales, Runoff, Price River, *Utah, Rainfall-runoff relationships, Suspended sediment, Infiltration, Channel scour, Soil creep, Rill erosion, Water pollution sources, Water quality control.

Simulated rainfall was applied to three landforms underlain by Mancos shale in the Price River Basin, Utah, to determine the relative yields of water, sediment, and salt from this saline sedimentary formation. The three types of soil were: (1) soil A-shale pediment/recent alluvium, (2) soil D-

shale pediment/recent alluvium, and (3) soil A and weathered shale dissected Mancos shale uplands. Final infiltration rates on residual shale derived soils were 0.13-0.50 cm per hour. No runoff was generated on cracked soils derived from aeolian deposits. A steep dissected Mancos shale upland produced 180 times the suspended sediment concentrations and 68 times the EC (indicating salinity) compared to a low relief shale pediment and recent alluvial surface. Rilling was responsible for 80% of the sediment produced on the steep dissected shales. Channel scour and soil creep were also significant contributors to sediment. An estimated 1.35 million g per ha per year of sediment is produced by the steep dissected shale uplands. Sediment plugs were effective in trapping sediments on a local basis to improve quality of water for stock ponds and irrigation canals. (Cassar-FRC)
W83-03150

2K. Chemical Processes

CALCIUM CARBONATE IN POSTGLACIAL LAKE ERIE SEDIMENT,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 2J.
W83-02809

RADIUM, THORIUM AND RADIOACTIVE LEAD ISOTOPES IN GROUNDWATERS: APPLICATION TO THE IN SITU DETERMINATION OF ADSORPTION-DESORPTION RATE CONSTANTS AND RETARDATION FACTORS,
Yale Univ., New Haven, CT. Dept. of Geology and Geophysics.
S. Krishnaswami, W. C. Graustein, K. K. Turekian, and J. F. Dowd.
Water Resources Research, Vol 18, No 6, p 1633-1675, December, 1982. 7 Fig, 8 Tab, 34 Ref.

Descriptors: *Radioisotopes, *Solute transport, *Adsorption, Fate of pollutants, Aquifers, Isotopes studies, Radium, Thorium, Lead, *Connecticut, Uranium, Radon, Polonium, Sorption, Groundwater, Radioactive wastes, Geochemistry, Chemistry, Chemical properties.

Five groundwater samples collected in different hydrogeologic settings (glacial drift acquifer, crystalline bedrock arkosic rocks of the Triassic-Jurassic age, and a deep unpumped well) in Connecticut were analyzed for the concentrations of major cations and the U and Th decay series, U238, Th234, Ra226, Rn222, Pb210, Po210, Th232, Ra228, Th228, and Ra224. Waters were all toxic and slightly alkaline, with < 2500 ppm total dissolved solids. The concentrations of Rn222 ranged from 845 to 11,900 decays per min per liter, which were 3-4 orders of magnitude greater than that of the short-lived Ra224, Ra228, and Th234, even though the supply of the four isotopes is similar. It was inferred that sorption removes Ra and Th from groundwater in about 3 min or less. The activity ratios of Ra224/Ra228 and Th234/Th228 show that desorption occurs in about 1 week or less and that equilibrium between solution and surface phases is established. Therefore, in situ retardation factors can be calculated directly from the isotopic data. These are 4500 to 200,000 for various nuclides in different aquifers. Since sorption time scales and retardation factors are not dependent on the specific nuclide or the hydrogeology of the aquifer, it is likely that other uncomplexed heavy metals and transuranic elements will behave similarly. These relationships may be applied to studies of transport of radioactive waste through saturated media. (Cassar-FRC)
W83-02937

NATURE AND EXTENT OF ACID SNOWPACKS IN PENNSYLVANIA,
Pennsylvania State Univ., University Park.
For primary bibliographic entry see Field 2C.
W83-02943

CHEMICAL COMPOSITION OF BULK PRECIPITATION IN THE NORTH-CENTRAL AND NORTHEASTERN UNITED STATES, DECEMBER 1980 THROUGH FEBRUARY 1981,
Geological Survey, Albany, NY. Water Resources Div.
N. E. Peters, and J. E. Bonelli.
Available from the Br. of Dist. USGS, 604 S. Pickett St. Alexandria, VA 22304. Geological Survey Circular 874, 1982. 63 p, 20 Fig, 5 Tab, 28 Ref.

Descriptors: *Chemistry of precipitation, *Snow, *Deposition, *Chemical analysis, Trace metals, Snow samplers, Sampling, Sites, *Bulk precipitation, North-central United States, Northeastern United States.

Bulk precipitation samples were collected at 180 sites in the north-central and north-eastern States for 3 months during winter 1980-81 to provide data on the distribution of chemical constituents. Concentrations and average daily loads of 28 dissolved constituents were determined. Sodium and chloride deposition was relatively high in coastal areas and near someurban centers. Regional patterns of hydrogen ion, nitrate, lead, and iron loading correlate well with each other and form a concentric pattern around the center of high deposition in eastern Ohio and western Pennsylvania, suggesting an urban-industrial source. Samples from this area had low pH (<4.2), whereas samples from southern Minnesota and Illinois had circumneutral pH (<5.7). The latter samples had high concentrations of calcium and total inorganic carbon, suggesting pH control by soil-derived carbonate minerals. Deposition patterns of ammonium, nitrate, and sulfate display regional highs in Illinois, Indiana, and southwestern Michigan, suggesting agricultural sources such as fertilizer. Median loads of zinc, iron, and lead were lower than reported in previous studies for North America. The apparent decrease in lead since 1950 throughout the area is attributed to reduced consumption of leaded fuels and lower deposition in winter. (USGS)
W83-02968

SALT GENERATION IN PYRITIC COAL SPOILS AND ITS EFFECT ON SATURATED HYDRAULIC CONDUCTIVITY,
Kentucky Agricultural Experiment Station, Lexington.
For primary bibliographic entry see Field 5B.
W83-03024

NUTRIENTS AND ACID IN RAIN AND DRY FALLOUT AT FAYETTEVILLE, ARKANSAS (1980-1982),
Arkansas Univ., Fayetteville. Dept. of Geology.
G. H. Wagner, and K. F. Steele.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-208264, Price codes: A05 in paper copy, A01 in microfiche. Water Resources Research Center Publication No 90, Univ. of Arkansas, Fayetteville, April 1983. 92 p, 24 Fig, 8 Tab, 14 Ref. OWWR A-051-ARK(1), 14-34-0001-0104.

Descriptors: *Acid rain, Metals, *Nutrients, *Rain, Fayetteville, *Arkansas, *Ion flux, Wind direction, *Atmospheric deposition, *Hydrogen ion concentration, Heavy metals, Iron, Zinc, *Chemistry of precipitation.

Wet and dry fallout at Fayetteville, Arkansas have been collected separately and analyzed since April, 1980. The precipitation-weighted-average pH for two yearly periods of rainfall were 4.72(6/80-5/81) and 4.75(6/81-5/82). This corresponds to a concentration of the acid ion, H super +, of about 18 parts per billon (ppb). Pure water in equilibrium with the CO sub f the air would have a pH of 5.65(2.2 ppb of H super +). The range of pH during this two year period was 3.86-4(140-0 ppb H super +) for the rainfall. Aqueous extracts of the dry fallout were always in the 6.75-7.87 pH range, i.e. ne utral to slightly alkaline. The slight amount of acidity in the Fayetteville rainfall should be easily neutralized by dry fallout and soil. Amonium bisulfate, NH sub 4 HSO sub 4; is the major acidic chemical in the rains. Sulfur tends to increase in winter months presumably due to the greater use of fossil fuels. Northern rains have the most acidity. Wet and dry fallout add significant amounts of nutrients to the local soils with 25-87% of the total flux being dry fallout. A major contributor are dust storms which bring in soil from adjacent states. Iron and zinc were the most prevalent heavy metals in the wet fallout. Their concentrations were very low averaging less than 10 ppb for Fe and 15 ppb for Zn. Northernly and southernly rains had the most Fe and Zn and correspond to directions in which there are smelters.
W83-03041

VARIATIONS IN GROUNDWATER QUALITY WITH DROUGHT,
Kansas Water Resources Research Inst., Manhattan.
For primary bibliographic entry see Field 5B.
W83-03044

METABOLIC PROPERTIES OF THIOBACILLUS FERROOXIDANS ISOLATED FROM NEUTRAL PH MINE DRAINAGE,
Alaska Univ., Fairbanks. Inst. of Water Resources.
For primary bibliographic entry see Field 5B.
W83-03045

POSSIBLE INFLUENCES UPON LAKE DEVELOPMENT IN THE EAST AFRICAN RIFT VALLEYS,
Massachusetts Univ., Amherst. Dept. of Geology and Geography.
For primary bibliographic entry see Field 2H.
W83-03115

CHEMISTRY OF SOUTH POLAR SNOW,
Laboratoire de Glaciologie et Geophysique de l'Environnement, Grenoble (France).
R. Delmas, M. Briat, and M. Legrand.
Journal of Geophysical Research Vol 87, No C6, p 4314-4318, May 20, 1982. 4 Fig, 2 Tab, 30 Ref.

Descriptors: *Snow, *Acidity, *Chemical composition, *Salts, *Antarctic, Precipitation, Trace elements, Aerosols, Deposition, Air entrainment, South Pole, Sulfates, Nitrates, Chlorides, Ammonium.

Data on the chemical composition of trace impurities in recent Antarctic snow is reviewed and analyzed. Sea salt is an important source of trace impurities in the coastal areas but not at the interior South Pole region (10-15% of total trace element deposition). Sodium concentrations in snow (times 10 to the minus 9th power g per g) were > 400 at the coast and as low as 4 at a distance 500-600 km from the sea. Impurities are essentially soluble (about 96%). The gas-derived ions (sulfates, nitrates, ammonium, and chlorides) are the major components in central Antarctic snow. Electro-conductivity measurements indicate a large proportion of hydrogen ions (38%) among the cations, which also include ammonium (10%) and sodium (6%). Antarctic snow melt water can be described as a very dilute mixture of natural acids, such as sulfuric and nitric, of pH 5 to 7, containing about 25% neutral salts. Possible origins of the chemical impurities are: sulfate--oxidation of marine gaseous compounds and deposition of volcanic sulfate; nitrate and ammonium--solar activity; and chloride--sea salt plus gaseous hydrogen chloride formed by reaction of sea salt and sulfuric acid in the atmosphere. (Cassar-FRC)
W83-03119

2L. Estuaries

MATHEMATICAL MODELLING OF ESTUARIES AND COASTAL WATERS,
Newcastle upon Tyne Univ. (England). Dept. of Civil Engineering.
A. James.
Water Science and Technology, Vol 14, No 9-11, p 1109-1123, 1982. 2 Tab, 125 Ref.

Descriptors: *Estuaries, *Model studies, *Planning, Coastal waters, Bacteria, Decision making, Water management, Water quality control, Mathematical studies, Water pollution control.

Modeling of estuaries and coastal waters has proceeded on divergent lines, since the common pollution problems in the two situations are different and the mechanisms responsible for dilution in the two waters are somewhat different. In estuaries the water quality if closely linked with the level of dissolved oxygen, with acute toxins as a secondary parameter. The greater dilution in coastal waters usually obviates any problems of deoxygenation or acute toxicity, so visual amenity and microbiological quality are the primary concerns. In coastal waters the initial mixing of the waste is due to entrainment of seawater in the buoyant jet and subsequently to advection and turbulent diffusion at the surface in a relatively unconfined area. Discharges to estuaries usually occur at or near the surface, so dispersion by advection and turbulent diffusion takes place in a confined area, where differences vertically and laterally may often be neglected. Various modeling factors used in these situations include hydraulic classification, validation and sensitivity analysis, economic models, modeling of initial dilution, modeling of surface spreading, and modeling of bacterial die-off. (Baker-FRC)
W83-02867

NUTRIENT-SALINITY RELATIONSHIPS IN FOUR ESTUARIES OF THE CAPE PROVINCE, SOUTH AFRICA,
National Research Inst. for Oceanology, Stellenbosch (South Africa).
For primary bibliographic entry see Field 5B.
W83-02889

ON LAGRANGIAN RESIDUAL CURRENTS WITH APPLICATIONS IN SOUTH SAN FRANCISCO BAY, CALIFORNIA,
Geological Survey, Menlo Park, CA.
R. T. Cheng, and V. Casulli.
Water Resources Research, Vol 18, No 6, p 1652-1662, December, 1982. 10 Fig, 26 Ref.

Descriptors: *Water circulation, *Water currents, *Lagrangian circulation, Bays, Estuaries, *San Francisco Bay, *California, Eulerian ciculation, Tidal effects, Tidal currents, Stokes' drift, Residual circulation, Wind-driven currents.

Following a classification and definition of residual variables in tidal estuarine flow, a method is outlined in which the Lagrangian residual circulation is computed directly using a two-stage formulation. First the tidal circulation in a basin is computed from the shallow water equations in a conventional Eulerian manner. Then tracer particles are released and followed by a numerical scheme patterned after the method of markers and cells. This approach was applied to South San Francisco Bay, California, which has a deep relict channel connected to a broad shallow shoal east of the channel. No major river flows into South Bay, and the tides here have properties similar to standing waves. It is concluded that estimating Lagrangian residual circulation from Eulerian data may be unacceptable because they are conceptually different and will never be the same. There is a small difference between the variables in the south end of the bay, but large differences near the center of the basin, where a sharp gradient exists between the channel and shoals. The two variables show a relationship only when tidal excursion is small compared to the topographic features of the basin (length scale of the basin). Wind forcing was found to play an important role in long-term circulation. (Cassar-FRC)
W83-02928

FLOW MODEL OF THE HUDSON RIVER ESTUARY FROM ALBANY TO NEW HAMBURG, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
D. A. Stedfast.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-110007, Price codes: A05 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 81-55, 1982. 69 p, 9 Fig, 3 Tab, 20 Ref.

Descriptors: *Computer models, *Estuaries, *Streamflow, *Unsteady flow, Surface water, Tidewater, Mathematical models, Discharge measurement, Data collections, Hydrographs, *New York, Hudson River estuary.

A one-dimensional transient-flow-simulation model was developed to represent a 76-mile reach of the tidal Hudson River between Albany and New Hamburg, N.Y. The river's direction of flow reverses four times daily as a result of tidal influence, and this process produces complex current patterns and retards the rate at which the river can flush out pollutants. In the model, the reach studied is treated as two subreaches to incorporate differences in channel conditions and to simplify model calibration. This report provides all stage (water-level) and discharge data that were used to calibrate and verify the model and compares the model results with measured data. The model accurately simulated observed flows, but further calibration based upon additional prototype flow measurements would improve simulation of the flow magnitude and phasing of the tide reversal under low-flow conditions. The model can be used to calculate instantaneous stage, velocity, and discharge for any location in the reach and can also be used to calculate net volume flux between tide reversals. (USGS)
W83-02986

COUPLING OF ONE- AND TWO-DIMENSIONAL FINITE ELEMENTS FOR THE COMPUTATION OF TIDAL FLOW IN ESTUARIES,
Karlsruhe Univ. (Germany, F.R.). Inst. fuer Hydromechanik.
B. Herrling.
Advances in Water Resources, Vol 5, No 4, p 227-232, December, 1982. 14 Fig, 11 Ref.

Descriptors: *Estuaries, *Tidal flows, *Model studies, Mathematical equations, Fluid mechanics, Hydraulics, *Finite element method, Mathematical studies, Elbe River estuary, *Federal Republic of Germany.

A new method for the numerical computation of tidal flow in estuaries is demonstrated. One- and two-dimensional finite elements are directly coupled in a single model requiring the solution of only one common set of equations for all unknown parameters in each time step. The inland region of the Elbe River and the channel system on the intertidal flats are modeled by applying a one-dimensional analysis, while the south-eastern part of emonstrated that water levels and discharges can be correctly computed by the model for the whole estuary region. The computed water levels are compared with measured hydrographs at different gauges on the Elbe River. It is emphasized that by using a one-dimensional analysis in parts of the model much computer time can be saved. Moreover it is possible, applying the new coupling mechanism, to reproduce special parts of a model by a two-dimensional discretization, for example, the area of construction in a river. (Baker-FRC)
W83-03051

COLLOCATION FORMULATIONS FOR THE FINITE ELEMENT ANALYSIS OF TIDAL AND TRANSPORT PROCESSES IN ESTUARIES,
Hanover Univ. (Germany, F.R.).
U. Meissner, and R. Ratke.
Advances in Water Resources, Vol 5, No 4, p 217-220, December, 1982. 2 Fig, 7 Ref.

Descriptors: *Estuaries, *Transport, *Tidal effects, Sediment transport, Estuarine environments, Tidal basins, Tidal currents, Waves, Heat transport, Thermal pollution, Thermal water, Heated water. *Finite element analysis.

The finite element method supplies a high flexibility for the modeling of complicated systems via its features of irregular mesh refinements and its ability of coupling different elements. Although the method is theoretically well analyzed and proves reliable, numerical problems remain which must be weighed with regard to accuracy and computer costs. The theoretical background of this approach is outlined. For the analysis of long-period tidal waves and the heat transport within the far-field of coastal waters, the governing equations are derived by vertical integrations over the water depth under the following assumptions: density gradients and velocity components in the vertical direction are negligible, the water is well mixed over the depth, and the influence of the temperature distribution on the tidal motion is negligible. For clearness of the derivation, only a formulation for one-dimensional models with rectangular width cross-sections is presented. A simulation of the thermal transport in a river under natural conditions has shown that the explicit model as described meets the requirement of being able to keep sharp fronts between cold and hot water as they may occur in a tidal river. (Baker-FRC)
W83-03055

STREAM FUNCTION FINITE ELEMENTS FOR NEARSHORE CURRENT,
Chuo Univ., Tokyo (Japan). Dept. of Civil Engineering.
M. Kawahara, and T. Takagi.
Advances in Water Resources, Vol 5, No 4, p 195-207, December, 1982. 27 Fig, 22 Ref.

Descriptors: *Coastal waters, *Mathematical equations, *Nearshore processes, *Water currents, Waves, Flow, Surface water, *Japan, Twan Bay, Streamflow, Streams, *Finite element analysis.

The finite element method is presented for the determination of surface wave and nearshore current. For the surface wave, the analysis of wave angle and wave height was carried out. The basic equations of wave angle and height variations are expressed by the conservation of wave number and wave energy respectively. The wave angle is determined from the conservation law of wave number. Radiation stress is derived from the wave angle and height. The nearshore current flow is obtained from the conservations of momentum and continuity, including the radiation stress. All the numerical procedures are based on the finite element method. For the analysis of the wave angle and wave height, the incremental iteration method and logarithmic function formulation are employed. For the analysis of the current flow, the stream function formulation is used. From the numerical computations, it is seen that the finite element method presented is valuable in practical applications. The method is applied to the analysis of the nearshore current flow of Twan Bay in Japan. (Baker-FRC)
W83-03064

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

SANITARY MICROBIOLOGIC ASSESSMENT OF WATER DESALINATION BY DISTILLATION (SANITARNO-MIKROBIOLOGICHESKAYA OTSENKA DISTILLYATSIONNOGO METODA OPRESNENIYA VODY),
Institute of General and Municipal Hygiene, Moscow (USSR).
Yu. A. Rakhmanin, A. I. Melnikova, and D. A. Selidovkin.
Gigiena i Sanitariia, No 1, p 12-15, 1980. 4 Ref. English summary.

Descriptors: *Desalination, *Evaporators, *Microorganisms, Water quality, *Distillation, Water pollution, Water pollution sources, Bacteria, Water vapor, Seawater, Drinking water, *Water treatment, *Microbiology, *USSR.

The desalination of highly mineralized waters on industrial evaporators may lead to a greatly reduced level of microbial contamination of the distillate, but this decontamination is not reliable. Microorganisms can be introduced from water vapor to the distillate due to the high vacuum within the inner circuit of the evaporator. Thus, the desalinated water must be purified by one of

the techniques commonly used for drinking water. (Author's abstract)
W83-03010

DESIGN AND EVALUATION OF AN AFVC WASH COLUMN WITH DIRECT MELTING ON THE ICE PLUG,
Heist Engineering Corp., Walnut Creek, CA.
J. A. Heist, and T. S. Barron.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-206870, Price codes: A05 in paper copy, A01 in microfiche. Completion Report, April 1983. 54 p, 6 Fig, 4 Tab, 33 Ref, 3 Append. OWRT(No 2416)(1), 14-34-0001-2416.

Descriptors: *Desalination plants, *Crystallization, *Distillation, Sea water, Water treatment, Industrial plants, Pilot plant, Mathematical studies, Finite crystallization, AFVC pilot plant, *Direct melt wash column.

Heist Engineering and the Office of Water Research jointly developed and satisfactorily tested a small-scale side stream direct melt wash column for the AFVC desalination pilot plant at the Wrightville Beach Test Facility. This evaluation of the direct melt approach was motivated by problems experienced with the existing AFVC wash column, particularly the air leaks that have been observed through the scraper shaft seal. The program also included a review of wash column design practice, and the identification of methods appropriate for design of commercial-scale direct melt units. Results at the small scale suggest that continued research, including both the conversion of the existing AFVC wash column to direct melt operation, and further development of design methods, should be pursued.
W83-03040

ENERGY RECOVERY FROM THE REJECT BRINE OF REVERSE OSMOSIS SYSTEMS,
Bechtel National, Inc., San Francisco, CA.
S. C. May, R. Soo-Hoo, D. J. Prend, and A. N. Rogers.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-209031, Price codes: A04 in paper copy, A01 in microfiche. Final Report, March 1981. 57 p, 19 Fig, 9 Tab, 9 Ref. OWRT C-90302-D(9528)(1), 14-34-0001-9528.

Descriptors: *Energy recovery, Flow work exchanger, Immiscible fluid energy recovery device, *Reverse osmosis, *Cost-energy recovery, *Desalination, Desalination plants, Brine, Seawater, Design, Performance.

A novel power recovery system, immiscible fluid energy recovery device (IFERD), for reverse osmosis desalting plants was investigated. Conceptual designs and cost estimates were developed for two commercial-sized seawater reverse osmosis desalting plant applications. An economic evaluation of the IFERD system when compared to conventional power recovery devices shows the IFERD system to be more economically attractive in most cases, except when power costs are extremely low. This is mainly due to its superior efficiency in both the recovery of energy and the application of the recovered energy. In addition, the IFERD system offers potentially increased reliability and reduced maintenance. Recommendations are made for pilot testing to demostrate the performance and reliability of the IFERD system and to obtain other data necessary to develop the IFERD system to the point of commercial use.
W83-03113

3B. Water Yield Improvement

OPTIMAL DESIGN OF SMALL RESERVOIR SYSTEMS,
P. N. Sharma, and O. J. Helweg.
Journal of the Irrigation and Drainage Division, Proceedings of the American Society of Civil Engineers, Vol 108, No 4, p 250-264, December, 1982. 6 Fig, 4 Tab, 9 Ref.

Descriptors: *Reservoir design, *Irrigation water, *Water harvesting, Optimization, Water supply, Semiarid lands, Hyderabad, *India, Ponds, Tropical regions, Water storage, Storage tanks, Design criteria, Systems analysis.

Systems analysis was applied to the design of tank systems suitable for water harvesting in the semi-arid tropics. The tanks are actually small reservoirs formed by earth dams or small excavated ponds to catch precipitation during the monsoon and hold it for use during the dry season. Tank volume, location, and dimensions are the components considered in the optimization problem. Some cases are constrained by catchment size, others are unconstrained. A sample problem for a catchment in Hyderabad, India, is given for both constrained and unconstrained cases. (Cassar-FRC)
W83-02836

SUPPLY OF A RURAL COMMUNITY IN THE RHONE DEPARTMENT BY MEANS OF MID-DEPTH DRILLING IN THE 'MOLASSE' OF THE BAS-DAUPHINE (ALIMENTATION D'UNE COMMUNE RURALE DU DEPARTMENT DU RHONE AU MOYEN D'UN FORAGE DE PROFONDEUR MOYENNE DANS LA ('MOLASSE' DU BAS-DAUPHINE),
J. Baetz, M. Clouet d'Orval, and J. Laye.
Techniques et Sciences Municipales, No 1, p 33-37, January, 1981. 2 Fig. (No English Summary).

Descriptors: *Groundwater potential, *Water supply development, *Groundwater mining, Water resources development, Sandstones, Aquifers, Groundwater quality, *France, Rhone.

Water resources for the community of Saint-Pierre-du-Chandieu, in the South of France, are somewhat limited. The community is located too far from the Rhone or other significant surface water resources to make their utilization practical. Groundwater possibilities have been investigated. In this case, it has been determined that water in the sandstone of the Bas-Dauphine would provide an important local water supply. The quality of the water in the sandstone is similar to that of local aquifers in more superficial ground, whose main drawback is the presence of nitrate concentrations near the admissible limits. Deep drilling, to a depth of between 100 and 150 meters, into the sandstone offers such advantages as ready implementation and an easy site location, but significant costs must be incurred without a certainty of finding water of sufficient quality and in sufficient quantity to justify the expense. It is suggested that in certain local and particular cases, after establishing a precise and well-researched inventory, the sandstone could be used for emergencies. However, the permanent water needs of the region must be met through the development of better structured supply and distribution systems for water from the alluvial aquifers nearer the surface. (Carroll-FRC)
W83-02845

3C. Use Of Water Of Impaired Quality

MICROBIOLOGICAL AEROSOLS FROM A FIELD-SOURCE WASTEWATER IRRIGATION SYSTEM,
Army Medical Bioengineering Research and Development Lab., Fort Detrick, MD.
For primary bibliographic entry see Field 5B.
W83-02835

PRODUCTION OF ALGAL PROTEIN IN RAW SEWAGE,
National Inst. for Water Research, Pretoria (South Africa).
E. Sandbank.
Water Science and Technology, Vol 14, No 9-11, p 1562-1563, 1982. 2 Tab.

Descriptors: *Proteins, *Raw wastewater, *Water reuse, Wastewater treatment, Feeds, Algae, Irrigation, Oxidation ponds, *South Africa.

The National Institute for Water Research is studying the production and processing of microalgae in a wastewater treatment pond with the dual purpose of treating sewage for irrigation purposes and producing algae intended as a feed or as raw material for chemical products. The objectives are to optimize algal production, study the effect of predators and means to prevent them, simplify the harvesting of microalgae, and reduce the costs of production and of the dewatering and drying processes, in order to develop an integrated system for the treatment of wastewater and algal production which could be applied in developing areas. Raw sewage is roughly filtered and fed continuously to the treatment pond. The raw sewage, pond effluent and the flotation effluent of the flotation unit were analyzed for ammonia, orthophosphate, chemical oxygen demand, chlorophyll a and suspended solids. Different alternative for drying the algal float are being tested, including drum-drying, microwave equipment for pathogen destruction and sun-drying, or combinations of thermal treatment and sun-drying. Dried algae have been sucessfully used in feeding trials with warm water fish and with poultry. (Baker-FRC)
W83-02856

STATEWIDE EVALUATION OF TRACE ELEMENT ACCUMULATION FROM LONG TERM DISPOSAL OF WASTE WATER,
California Univ., Irvine.
B. H. Olson, D. C. Hill, and M. G. Rigby.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-196444, Price codes: A07 in paper copy, A01 in microfiche. Completion Report, California Water Resources Center, California Univ. Davis, March 1983. 128 p, 6 Fig, 46 Tab, 125 Ref. OWRT B-207-CAL(1).

Descriptors: *Wastewater, *Wastewater disposal, *Land disposal, Water reuse, *Trace metals, *Path of pollutants, *Trace elements, *California, Water pollution sources, Soil contamination, Water quality control.

In this study twenty reuse sampling sites were selected on the basis of the following criteria: length of time the site has received wastewater, amount and manner of application, quality of wastewater applied, and the availability of historical data on trace element content in wastewater effluent. Each site was visited once during the two year study. Both soil and vegetation samples were collected from each site. These samples were analyzed for Cd, Cu, Pb, Ni and Zn content. Soil samples were also analyzed for pH, CEC and water content. Results indicated that 9% of the fields investigated showed an accumulation of trace elements from reuse practices. Metal enrichment was confined to the upper layers of soil, but penetrated into the soil column depending on soil type and rate of wastewater application. Translocation of metals into plants from these sites was dependent on the plant species as well as the given metal. Cadmium and Zn were the most mobil of the metals tested. This investigation concludes that land application of wastewater provides useful irrigation waters under most circumstances. Metal accumulation was noted only for fields which had not been ploughed. Filling the soil most likely dilutes the amount of metal in a given cm core by spreading it over the depth of tillage. Increased chances for significant elevation of soil metal occurs when the level of treatment is reduced below secondary, when the application rate is increased, or if a high percentage of wastewater is from industrial sources. (Snyder, Calif.)
W83-02892

INFILTRATION AS AFFECTED BY LONG-TERM USE OF SODIC-SALINE WATER FOR IRRIGATION,
Agricultural Research Organization, Bet-Dagan (Israel). Div. of Soil Physics.
A. Hadas, and H. Frenkel.
Soil and Science Society of America Journal, Vol 46, No 3, p 524-530, May/June, 1982, 4 Fig, 5 Tab, 19 Ref.

Descriptors: *Infiltration rates, *Saline water, *Soil surfaces, Irrigation water, *Israel, Hydraulic

conductivity, Runoff, Cotton, Soil texture, Gypsum, Water pollution effects, Semiarid lands.

Infiltration rates were determined in cotton fields located on the southern central plain of Israel. Irrigation water was sodic-saline, EC = 5.6 mmho per cm and sodium absorption ratio of 26. The infiltration rates were in the following descending order: saline-sodic water + gypsum treatment > saline-sodic water, untreated soil > distilled water + gypsum treatment > distilled water. Fields irrigated for 8 years with the saline-sodic water had higher infiltration rates than the fields irrigated for 2 years. This was a result of the difference in crust structure. The soil surface in the field irrigated for 8 years was well cracked and underlain by a crumbly soil. This underlayer was absent in the field irrigated for only 2 years. The hydraulic conductivities of the crusts showed the same trends as the infiltration rates. The calculated hydraulic conductivities and infiltration rates for unponded conditions also followed the same trends as values for high hydraulic head. (Cassar-FRC)
W83-03016

EVALUATING POTENTIAL HEALTH RISKS OF CONSUMING REUSED WATER,
Chemical Industry Inst. of Toxicology, Research Triangle Park, NC.
For primary bibliographic entry see Field 5C.
W83-03086

3D. Conservation In Domestic and Municipal Use

WATER RECYCLING SYSTEMS,
American Water Works Association Research Foundation, Denver, CO.
R. D. Heaton.
Water Science and Technology, Vol 11, No 9-11, p 1393-1429, 1982. 27 Fig, 20 Tab, 3 Ref.

Descriptors: *Water reuse, *Wastewater treatment, Recreation demand, Irrigation, Water demand, Water management, Water supply development, Financial aspects, Decision making.

The treatment given to municipal wastewater for community reuse is determined by the intended use, institutional considerations, economics, and health considerations and quality criteria. In order to identify the most promising users in a given location the chief characteristics of all local markets for water must be considered. The following factors must be considered: who are the large water consumers; is water use characterized by wide spread domestic use or are dominant consumers evident; what domestic, industrial, agricultural or recreational water users might as well be served by reclaimed water; what factors of water use such as residential growth, irrigation needs, industrial development, are forcing new and increasingly expensive sources; and what are the volumes and cost of a user's present water supply. In order to extract potentially viable reuse schemes from literally thousands of possibilities and integrate the survey and subsequent evaluation with other interested agencies a 10-step screening process was designed as follows. List all possible types of reuse; 65 of these were identified. Compare the types of reuse to both the current and anticipated regulations of the Department of Health Services and to the experience obtained in other parts of the country. A total of over 1,000 sites was identified in the 200 sq mile area as possible locations for priority reuse applications. Of these 1,000, those that would use less than ten acre-feet per year were dropped as uneconomical. Through further refinement 18 feasible projects were identified, which included 6 industrial users, 3 agricultural users, 2 golf courses, 6 parks and 3 freshwater marshes using a combined total of more than 13,000 acre-feet per year. Various water recycling systems are cited and described as they relate to these 18 potential projects. (Baker-FRC)
W83-02878

WATER CONSERVATION KITS: A TIME SERIES ANALYSIS OF A CONSERVATION POLICY,
California Univ., Santa Barbara. Dept. of Economics.
W. D. Morgan.
Water Resources Bulletin, Vol 18, No 6, p 1039-1042, December, 1982. 2 Tab, 15 Ref.

Descriptors: *Water consumption, *Time series analysis, Water conservation, Water use, Oxnard, *California, Regression analysis, Property value.

Installation of water conservation kits in the households of a section of Oxnard, California, reduced average bimonthly water use by 3,101 cu ft or 4.2%. An estimated 62.5% of households installed some portion of the kit, which included a water guard to reduce toilet flushing water, a shower head flow restrictor, and dye tablets to detect toilet storage tank leaks. Probability of installing the kit was not related to age of resident, number of people in household, or years lived in house. Residents living in houses older than 20 yr or houses in poor condition were less likely to install the kits. The most important factor favoring the probability of installation was a high assessed value. (Cassar-FRC)
W83-03136

3E. Conservation In Industry

WATER RECYCLING: REVIEW AND BACKGROUND,
Black and Veatch, Denver, CO.
K. D. Linstedt.
Water Science and Technology, Vol 14, No 9-11, p 1385-1392, 1982. 4 Fig, 1 Tab, 9 Ref.

Descriptors: *Water reuse, *Water demand, Water management, Wastewater treatment, Irrigation, Potable water, Water supplies, Public opinion, Financial aspects.

The world water resource situation is reviewed. Water reuse is described as a means of augmenting conventional supplies, with types of potential reuse applications cited. Water quality, cost public acceptance and institutional constraints are identified as they affect water reuse programs. While there is substantial excess runoff on a worldwide basis, the geographical distribution of precipitation and runoff is not uniform. Much of the world water resource is concentrated in land areas of relatively low population in South America, Central America, Africa, and Southeast Asia. Water reuse can be described as indirect when water from domestic or industrial sites is discharged into receiving waters and withdrawn again for a subsequent use. Direct reuse situations are those that occur as a direct result of planned and deliberate use of treated wastewater for beneficial purposes such as irrigation, industry, groundwater recharge, and potable supply. The term 'water recycling' is often used to describe internal reuse of wastewaters prior to discharge, particularly in an industrial context. Water quality considerations will vary with the intended reuse of the water. For example, an agricultural irrigation application must consider microorganisms, dissolved salts, heavy metals and suspended solids. In industrial reuse categories corrosion inhibitors, foaming agents, and nutrient content are significant. Costs vary with the degree of treatment needed and may also be significantly affected by the need to transport and distribute the water from point of treatment to the point of reuse. Public acceptance varies with the perceived level of contact that the public will have with the renovated water source. As the level of contact is reduced, acceptability of the reuse program increases. (Baker-FRC)
W83-02877

WATER RECYCLING - INDUSTRIAL APPLICATIONS,
Ruhrverband, Essen (Germany, F.R.).
D. R. Albrecht, and K. R. Imhoff.
Water Science and Technology, Vol 14, No 9-11, p 1431-1445, 1982. 11 Fig, 1 Tab, 18 Ref.

Descriptors: *Water reuse, *Water demand, *Industrial water, Water supply, Financial aspects, Industrial wastewater, Wastewater treatment, Pulp and paper industry, Pickling, Metal-finishing wastes, Sugars, Steel industry, Powerplants, Sulfite.

Industrial water recycling techniques are used in such varied industrial settings as steel production, pickling and plating, coal mining and coking, sulfite cellulose and paper production, sugar works and power plants. Special consideration is given to water recycling in metal finishing works and paper mills. Increasing water prices and effluent charges along with regional water scarcity are considerable incentives for the application of industrial water recycling systems. Depending on different production procedures various types of industrial water cycles are available. Due to the scarcity of water and the required effluent quality, at the Salzgitter steel mill the fresh water demand was lowered from 84 cubic meter/ton of steel to only 4 cubic meter/ton by water reuse. In picking and plating plants all measures of water saving must start with the rinsing process. The rinse water demand of electroplating baths can be lowered by continuous conductivity control. At paper mills, water measurement at eight important locations within the production process can result in savings. Other factors include pulp solution by recycled 'thick water' from a new substance reclamation plant, collection and recycling of cooling waters, application of non-water-sealing bushings in pumps, use of clear water from substance reclamation as spray water for paper machines, performance of consistency regulation with thick water and clear water, and the installation of two water cycles in conjunction with a filter belt at the paper machines. Sufficiently clarified water can even be recycled to the grinding plant. (Baker-FRC)
W83-02879

THE EXHAUSTIVE REUSE OF WATER IN FOOD PROCESSING,
Manitoba Univ., Winnipeg. Dept. of Food Science.
R. A. Gallop, A. W. Hydamaka, B. J. Clark, and L. B. Carvalho.
Water Science and Technology, Vol 14, No 9-11, p 1549-1550, 1982.

Descriptors: *Food processing, *Water reuse, Wastewater renovation, Water use, Water supply, Water resources development, Recycling, Industrial water, Heat transfer, Mass transfer.

The increasing need for larger and larger supplies of food dictates increasing use of recycled water in food processing. The major roles for water usage in food processing are for heat transfer and mass transfer, mostly during in-plant operations, which can be mostly made highly cyclic to great advantage. The symbiotic use of solid wastes from food plants as filter aids, as fuels, and as substrates for the on-site production of very good activated carbons is the best way to solve many problems. Skillful use of the solid wastes can permit food processing waters, especially the edible ones normally rejected as wastes, to be used as processing aids, which will greatly improve the productivity of such lines while permitting the same volume of original water to be safely used to practical exhaustion over many weeks or longer. The recovery of water from process plumes by condensation for heat recovery or from process streams can soon supply plants with more than 100% of their daily on-site water needs for makeup to the virtually closed loop total process systems now required. (Baker-FRC)
W83-02884

THE PERFORMANCE OF AN ULTRAFILTRATION PILOT-PLANT FOR THE CLOSED LOOP RECYCLING OF TEXTILE DESIZING EFFLUENTS,
Natal Univ., Durban (South Africa).
For primary bibliographic entry see Field 5D.
W83-03123

3F. Conservation In Agriculture

WATER POLICY: A CALIFORNIA SPLIT,
K. Cook.
Journal of Soil and Water Conservation, Vol 37, No 6, p 329-332, November/December, 1982.

Descriptors: *Water policy, *Water conservation, *Irrigation efficiency, Water law, *California, Legal aspects, Agriculture, Water use efficiency, Water management, Public participation.

In the November 1982 election California voters faced decisions on 15 statewide initiatives in addition to the candidates and questions of local policy. Proposition 13 was: Should our state water laws be changed to mandate conservation of surface and groundwater supplies. The vote was 35% in favor and 65% opposed. Although 87% of the state's water use is agricultural, 90% of the users are urban. The question was difficult to decide intelligently because of the complex legal implications. Much money was spent to proponents and opponents on propaganda and publicity. The appearance of the water initiative on the ballot points out the split in California water policy. Water use efficiency is 60% in California at present, greater in the south than in the north. There is room for improvement in irrigation efficiency, since many farmers apply water by a strict schedule, disregarding weather conditions and crop needs. Water prices vary from $1 to $150 per acre-foot throughout the state. Many irrigation districts structure their prices to ensure full use of their water entitlement. The recently launched California Irrigation Management Information System is designed to give scheduling information from 40 automated weather stations to aid in improving irrigation efficiency. (Cassar-FRC)
W83-02838

IS THE OGALLALA GOING DRY.
Nebraska Univ.-Lincoln. Dept. of Agricultural Economics.
R. J. Supalla, R. R. Lansford, and N. R. Gollehon.
Journal of Soil and Water Conservation, Vol 37, No 6, p 310-314, November/December, 1982. 6 Tab, 7 Ref.

Descriptors: *Groundwater depletion, *Aquifers, *Water shortage, *Ogallala Aquifer, Groundwater availability, High Plains Study, Economic aspects, Cost analysis, Agriculture, Farming, Dry farmig, Water management, Water policy, Water supply, Planning, Water transfer, Water table decline, Groundwater management, Water conservation.

Concern over diminishing water supplies from the Ogallala Aquifer initiated the High Plains Study, authorized by Congress in 1976. It concluded that groundwater shortages are not present in the six-state region except in localized areas. Although different analysts could reach different conclusions from the results of the study, this paper agrees with the statement that problems in agricultural production or economic viability are confined to some areas of some states. Education and research on dryland agriculture and programs designed to attract nonwater-intensive industry will probably be the best long-term solutions to the problems. Mandatory pumping restrictions would extend the aquifer life at an unacceptably high economic cost; this should only be applied in local problem areas affected by groundwater exhaustion. Large intrastate and interstate water supply augmentation projects, considered only for Oklahoma and Nebraska, will not be economically feasible for at least the next 40 years, if ever. Costs of delivering water by large scale transfer would be up to 10 times the irrigation benefits. (Cassar-FRC)
W83-02839

WATER RECYCLING: REVIEW AND BACKGROUND,
Black and Veatch, Denver, CO.
For primary bibliographic entry see Field 3E.
W83-02877

WATER REQUIREMENTS FOR FLOODED RICE CULTIVATION,
Binnie and Partners, London (England).
W. M. Clark, M. E. Bramley, and R. F. Thorp.
Proceedings of the Institution of Civil Engineers, Part 2: Research and Theory, Vol 73, No 4, p 769-788, December, 1982. 7 Fig, 3 Tab, 16 Ref.

Descriptors: *Rice, *Irrigation efficiency, *Water requirements, Crop growth, Scheduling, Water conservation, Humid climates, *Indonesia.

This paper addresses the practical aspects of calculating water requirements for rice cultivation. Many previous methods have not considered local farming and operating requirements and have concentrated on maximum area of irrigation rather than maximum rice production. Peak water demands occur during presaturation, which is the initial stage of land preparation for transplanting. Most existing formulas use a 14-21 day presaturation period, whereas a minimum of 28 days is seen in practice for individual farms. A scheme is presented for determining the water requirements of this presaturation period based on soil saturation, depth of desired water layer, evaporation, percolation, and duration of the presaturation period. Water requirements for the period of crop growth are obtained with standard methods for other crops, also considering some problems unique to flooded rice. The gongolan (group) arrangement used in Indonesia is a water scheduling arrangement in which water from the primary canal is divided into three secondary canals, supplying water to subunits. Several schemes of water application are possible. These involve combinations of several factors: different starting dates, cropping intensity, and continuous or rotational irrigation. (Cassar-FRC)
W83-03002

GROUNDWATER RESOURCES IN THE JUAREZ-EL PASO REGION (DE AGUAS SUBTERRANEAS EN LA REGION DE JUAREZ-EL PASO),
Escuela Superior de Agricultura Hermanos Escobar, Chihuahua (Mexico). Area de Manejo de Agua y Suelo.
For primary bibliographic entry see Field 2F.
W83-03020

IRRIGATION WATER MANAGEMENT FOR WIDE-SPACED FURROW IRRIGATION,
Oklahoma State Univ., Stillwater. Dept. of Agronomy.
J. F. Stone, M. E. Hodges, J. E. Garton, and H. E. Reeves.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-206847, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Institute Completion Report, Oklahoma State Univ., Stillwater, March 1983. 22 p, 2 Fig, 4 Tab, 11 Ref. OWRT A-090-OKLA(2), 14-34-0001-1138.

Descriptors: *Irrigation design, *Surface irrigation, *Water conservation, *Water management, Agricultural hydrology, Conservation, Groundwater irrigation, Irrigation, Irrigation practices, Soil water, Varied flow, Water requirements, *Oklahoma, *Furrow irrigation, Sorghum, *Irrigation scheduling.

The study was conducted at the Panhandle Research Station at Goodwell, Oklahoma. Two furrow spacings were studied in the production of bedded grain sorghum. Rows were 1/2 mile long. Two rows of grain sorghum were planted on each bed, with bed and furrow spacing of 56 in. The wide-spaced furrow irrigation was accomplished by irrigating alternate furrows, making the spacing 112 in. A replicated design was employed. Soil water content was measured at points approximately 50, 700, 1400, and 2000 ft. from the point of water application. Irrigation was scheduled for 14-day intervals, with portable H-flumes to set the flow rates. Problems with irrigation wells caused the application periods to be far longer, making the yield management and water savings portion of the study unrealistic. However, the portion of the study dealing with examining methods to apply water uniformly to the field with long rows was successful. The rates of advance of water in the wide-spaced furrows and the every-furrow irrigation were equally variable for the soils and slopes of this study. When furrow streams in the wide-spaced furrow plots were adjusted to advance through the field at the same rate as the every-furrow irrigation plots, the depth of penetration of water was uniform and nearly equal for the entire length of furrow. By noting how much faster water advances through a field when using every-furrow in contrast to wide-space furrow irrigation, one can proportionally adjust the furrow stream of the wide-spaced treatment to achieve application of water equally uniformly under both treatments. Such measurements of rate of advance can be made at the start of irrigation if the field is uniform in type and slope. Longer sets and measurements did not add sufficient information to be worthwhile.
W83-03037

WATER MANAGEMENT AND SALINITY CONTROL IN IRRIGATED SWELLING AND SHRINKING SOILS,
Oklahoma State Univ., Stillwater. Research Foundation Electronics Lab.
D. L. Nofziger, J. R. Williams, and P. Hemyari.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-206854, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Institute Completion Report, Oklahoma State Univ., Stillwater, March, 1983. 33 p, 11 Fig, 8 Ref, 2 Append. OWRT B-053-OKLA(1), 14-34-0001-0244.

Descriptors: *Irrigation practices, *Expansive soils, *Salinity control, *Crop yield, *Furrow irrigation, Resistivity, Water use efficiency, Unsaturated flow, Hydraulic conductivity, Soil water, *Oklahoma, *Soil salinity.

The influence of different irrigation management systems on crop production, water-use efficiency, and soil salinity was investigated for swelling and shrinking soil in southwestern Oklahoma. Crop production increased significantly each year as the amount of irrigation water increased. Irrigation water-use efficiency decreased as the amount of water increased. No differences in salinity due to irrigation treatments were detected but salinity decreased over time for all treatments. Water content and potential measurements indicated that little irrigation water moved below the 30-cm depth. Therefore, little leaching occurred during the irrigation season. A field resistivity probe was developed and calibrated to facilitate the future monitoring of soil salinity. The unsaturated hydraulic conductivity of this soil was measured in situ at 5 locations. These results are presented. Soil salanity was determined before and after applying 30 to 45 cm of water to each plot. Large salinity decreases were observed to depths of 60 cm in these plots. More research will be needed to evaluate this practice on a field scale.
W83-03038

FIELD TESTS UNDERWQY FOR THREE NEW AGRICULTURAL POLYMERS.
World Water, Vol 5, No 8, p 38-39, August, 1982. 2 Fig.

Descriptors: *Soil treatment, *Arid lands, *Irrigation, Sand, *Polymers, Agriculture, Plant growth, Water conservation, Agrosoke, Soil surfaces, Soil stabilization.

Chemical soil conditioners have improved plant growth during field trials in several arid regions. The polymeric products include Agrosoke, which absorbs up to 30 times its original weight in water for later absorption by plant roots; Agrosoke Erosel, a soil surface stabilizer; and Agrosoke Bintex, a spray-on binding agent for the soil surface. Although costs of these chemicals are high, they can be economically used where irrigation water is expensive. The chemicals can be useful, not only in growing crops, but in desert reclamation, protection of seashores and river banks, drainage channels, and irrigation channels. In an Abu Dhabi landscaping pilot study about $150 per week

in water costs was saved per 100 sg m treated soil. (Cassar-FRC)
W83-03129

URUGUAY'S SAVE OUR SOILS CAMPAIGN.
For primary bibliographic entry see Field 4D.
W83-03134

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

REPRODUCTIVELY LIMITED GRASS CARP FOR BIOLOGICAL CONTROL OF AQUATIC WEEDS--BROODSTOCK PRODUCTION AND TESTING,
Alabama Cooperative Fishery Research Unit, Auburn.
W. L. Shelton.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-196501. Water Resources Research Institute Completion Report, Auburn Univ., Alabama, April 1983, 41 p, 4 Fig, 14 Tab, 57 Ref. OWRT A-088-ALA(1), OWP 14-34-0001-2101.

Descriptors: *Carp, *Commerical fish, *Aquatic weed control, *Fish repoduction, Gonads, Sterility, Breeding, Grass carp, Macrophytes, *Biocontrol, Fish stocking.

The Chinese grass carp eats tremendous quantities of macrophytes and is thus a potentially valuable biological means of combating the escalating aquatic weed problem in the U.S., but stocking this exotic fish has not been widely accepted because of the fear of ecological repercussions should spawning and naturalization occur. The present approach to control unwanted reproduction has been to sex reverse female grass carp into functional males and use then in a breeding program that should produce only females which could be used in stocking for weed control. The two previous phases of this long-term study described the critical period of gonadal differentiation and developed an effective system for delivering the sex-reversing hormone and accomplished initial progeny testing to validate the basic hypothesis. During the last year, the sex-reversal treatment was more clearly defined by determining appropriate stocking rate limits during hormone delivery. It was found that sex reversal can be effected at stocking densities as high as 14,000 per hectare. Progeny tests of two year classes has confirmed the production of only females in the offspring of eight sex-reversed males (genetic females); 1,166 offspring were sexed from these two year classes. A third year class was produced and will provide additional data to test the basic hypothesis. Finally, treatment was initiated to develop replacement sex-reversed male broodstock for future use; the best available treatment regime was used to develop this group of potential broodstock. Limited numbers of monosex progeny have been stocked for actual management and additional utilization is anticipated.
W83-02898

MANAGEMENT OF EXISTING RESERVOIR SYSTEMS BY INTERACTIVE OPTIMIZATION,
Purdue Univ., Lafayette, IN. Water Resources Research Center.
For primary bibliographic entry see Field 6A.
W83-02924

INCREMENTAL DYNAMIC PROGRAMMING MAY YIELD NONOPTIMAL SOLUTIONS,
Hydro-Quebec, Varennes.
A. Turgeon.
Water Resources Research, Vol 18, No 6, p 1599-1604, December, 1982. 9 Fig, 3 Tab, 4 Ref.

Descriptors: *Dynamic programming, *Model studies, *Optimization, Reservoir operation.

Incremental dynamic programming, a procedure that permits the memory requirement of dynamic programming to be reduced, is widely used in water resources research. In some cases this method may produce a nonoptimal solution if the same state increment is used for every stage. A sample problem attempts to determine the maximum amount of water in storage in a reservoir at the beginning of each week, given that the river flow at a certain site must not exceed a given value. By changing the increment sizes in each stage, the desired results are obtained. (Cassar-FRC)
W83-02941

TECHNIQUES FOR ESTIMATING MAGNITUDE AND FREQUENCY OF FLOODS IN SOUTH CAROLINA,
Geological Survey, Columbia, SC. Water Resources Div.
For primary bibliographic entry see Field 2E.
W83-02979

STORAGE REQUIREMENTS TO SUSTAIN GROSS RESERVOIR OUTFLOW FROM SMALL BASINS IN KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
For primary bibliographic entry see Field 2E.
W83-02992

THE EFFECT OF TURFGRASS THATCH ON WATER INFILTRATION RATES,
Minnesota Univ., St. Paul. Dept. of Horticultural Science and Landscape Architecture.
D. H. Taylor, and G. R. Blake.
Soil Science Society of America Journal, Vol 46, No 3, p 616-619, May/June, 1982. 2 Fig, 5 Tab, 4 Ref.

Descriptors: *Infiltration rate, *Grasses, *Soil surface, Turf grasses, Thatch, Golf courses, Organic matter.

The effect of a thatch layer on water infiltration rate in athletic turfgrass areas was studied in laboratory packed sand colums and in field tests at 9 high-sand locations, including golf greens, a football field, and roof gardens. Thatch did not restrict the flow of water into the sand after an initial wetting period of about 10 min. Average time for the first 2 cm of water to infiltrate into sand with no thatch was 0.36 min and with dry thatch, 6.34 min. After the steady state was reached, the time for infiltration of 2 cm of water was 1.7-1.8 min. The equilibrium infiltration rates were not affected by packing the thatch or packing the sand surface. However, loosening the sand surface increased infiltration rates with and without thatch. In the field tests removal of the thatch layer did not significantly change the infiltration rates in 6 locations. At the other three sites infiltration rates decreased, possibly as a result of pore plugging or air entrapment in the soil samples. (Cassar-FRC)
W83-03023

OVERLAND FLOW FROM SLOPING LAND: EFFECTS OF PERCHED WATER TABLES AND SUBSURFACE DRAINS,
Oregon State Univ., Corvallis. Agricultural Experiment Station.
B. Lowery, G. F. Kling, and J. A. Vomocil.
Soil Science Society of America Journal, Vol 46, No 1, p 93-99, January/February, 1982. 3 Fig, 5 Tab, 18 Ref.

Descriptors: *Water table fluctations, *Seepage control, *Overland flow, *Perched water table, *Surface sealing, Subsurface drainage, Watersheds, Water management, Rainfall intensity, Antecedent moisture, *Hydraulic conductivity, Runoff, Drainage effects, Slopes, Willamette Valley, *Oregon.

The cause of overland flow from sloping fall-planted agricultural watersheds in the Willamette Valley, Oregon, foothills was ephemeral perched water tables, high antecedent soil moisture levels, and seepage zones. A minor amount of overland flow resulted from soil surface sealing and freezing. The temporary perched water tables developed because of restrictive layers in the soil and from heavy storms. The water table was nearer the ground surface at lower landscape positions than at the hilltops. Subsurface drains installed in a 1.4 ha watershed eliminated seepage areas, reduced the occurrences of the ephemeral perched water tables, and eliminated baseflow. Overland flow continued to occur after some storm events with high rainfall intensity or long duration, especially if antecedent moisture was high. The drains were particularly effective in reducing runoff in early winter before growth of the vegetative cover. (Cassar-FRC)
W83-03028

BIOLOGICAL AND RECREATIONAL ASPECTS OF WATER LEVEL MANAGEMENT FOR CLEAR LAKE, IOWA,
Iowa State Univ., Ames. Dept. of Animal Ecology.
For primary bibliographic entry see Field 6G.
W83-03036

EVALUATION OF RAPID RESERVOIR STORAGE-YIELD PROCEDURES,
Victoria State Rivers and Water Supply Commission, Armadale (Australia).
C. H. Teoh, and T. A. McMahon.
Advances in Water Resources, Vol 5, No 4, p 208-216, December, 1982. 9 Fig, 3 Tab, 16 Ref.

Descriptors: *Reservoir storage, *Mathematical equations, *Design criteria, *Evaluation, Water supply, Water management, Water storage, Storage, Reservoirs, Water supply development, Construction, Australia, Malaysia.

Rapid storage-yield procedures were reviewed and evaluated by a theoretical examination of each procedure and by application of each procedure to selected streams. The eight procedures studied were Hurst (empirical), Alexander (gamma), Gould (synthetic), Dincer, Gould (gamma), Hardison (carryover), and Guglij and McMahon (empirical). Each procedure was applied to 3 Australian and 12 Malaysian stream s. The storage estimates determined from the rapid procedures were compared with those from behavior (or simulaton) analysis and Gould's transition matrix method. Limitations in theoretical models result from the basic assumptions upon which they were developed. For empirical models, difficulties arise through the non-representativeness of the basic data. Some procedures are restricted in the range of conditions within which they are applicable. The results indicate that Gould's (gamma) and McMahon's (empirical) procedures provide satisfactory storage estimates for preliminary assessments. Both these procedures are recommended for use during preliminary design. However, because insufficient independent testing was carried out, the latter method should be restricted in application to Australian and Malaysian streams. Alexander's (gamma) and Hardison's (carryover) procedures are acceptable, though not recommended for determining storage estimates for preliminary design purposes. Hurst's (empirical), Gould's (synthetic), Guglij's and Dincer's procedures are generally unsatisfactory. They are either limited by theoretical assumptions and/or restricted by the range of conditions within which they are acceptable. (Baker-FRC)
W83-03061

OPTIMAL ANNUAL OPERATION OF A WATER SUPPLY AND DISTRIBUTION SYSTEM,
Mekoroth Water Co., Haifa (Israel).
For primary bibliographic entry see Field 6A.
W83-03062

METHODS FOR DERIVING OPERATING RULE CURVES FOR MULTIPLE RESERVOIR SYSTEMS,
Cornell Univ., Ithaca, NY. Center for Environmental Research.
D. P. Loucks, and J. R. Stedinger.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-208330,

Price codes: A03 in paper copy, A01 in microfiche. Completion Report, March 1983. 20 p, 3 Fig, 4 Tab, 24 Ref. OWRT B-094-NY(1), 14-34-0001-1250.

Descriptors: *Reservoir management, *Reservoir operations, *Risk, Hydropower, Reliability, Optimization, Linear programming, Linear-decision-rules, Reservoir design, Algorithms, *Optimal development plans, Decision making, Resiliency, Vulnerability.

Studies undertaken examined procedures to improve the efficiency with which reservoir systems are operated and to improve the tools for studying such systems. Three risk-based criteria (reliability, resiliency and vulnerability) for describing reservoir system operation were developed. These criteria illustrated the sensitivity of a reservoir system's performance to the objective function employed to derive its operating policy. Several families of multi-reservoir screening models were examined. Models based on mean-monthly flows performed very poorly as did linear-decision-rule (LDR) chance constrained models. The latter, which have been proposed as simple reservoir screening models and used to derive reservoir operating policies, were found to be of questionable value for screening models and used to derive reservoir operating policies, were found to be of questionable value for screening purposes in water supply problems with flood storage constraints; likewise, they were shown to generate very inefficient operating policies. Finally, three algorithms for optimizing the operation of multireservoir hydropower systems with a deterministic flow forecast were developed and compared. A sequential linear programming (SLP) approach always found the optimal solution in somewhat less time than an improved version of Becker and Yeh's linear-dynamic programming model. A new optimal control algorithm was faster than the SLP procedure but is difficult to implement.
W83-03094

4B. Groundwater Management

GEOTHERMAL RESOURCES IN THE BANBURY HOT SPRINGS AREA, TWIN FALLS COUNTY, IDAHO,
Geological Survey, Boise, ID. Water Resources Div.
For primary bibliographic entry see Field 2F.
W83-02972

GEOLOGIC AND WELL-CONSTRUCTION DATA FOR THE H-7 BOREHOLE COMPLEX NEAR THE PROPOSED WASTE ISOLATION PILOT PLANT SITE, SOUTHEASTERN NEW MEXICO,
Fenix and Scisson, Inc., Tulsa, OK.
S. L. Drellack, Jr, and J. G. Wells.
Available from the National Technical Information Service, Springfield, VA 22161. Geological Survey Water-Resources Investigations 82-38, April 1982. 25 p, 2 Fig, 1 plate, 7 Tab, 11 Ref.

Descriptors: *Cores, *Boreholes, *Radioactive waste disposal, *Core drilling, Geologic units, Drillers logs, Data collections, Groundwater movement, *New Mexico, Waste Isolation Pilot Plant.

The H-7 borehole complex, a group of three closely spaced boreholes, is located two miles southwest of the proposed Waste Isolation Pilot Plant site in east-central Eddy County, New Mexico. The holes were drilled during September and October 1979 to obtain geologic and hydrologic data to better define the regional ground-water-flow system. The geologic data presented in this report are part of a site-characterization study for the possible storage of defense-associated radioactive wastes within salt beds of the Salado Formation of Permian age. The geologic data include detailed descriptions of cores, cuttings, and geophysical logs. (USGS)
W83-02977

AQUIFER TEST RESULTS, GREEN SWAMP AREA, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 2F.
W83-02980

EVAPOTRANSPIRATION OF APPLIED WATER, CENTRAL VALLEY, CALIFORNIA, 1957-78,
Geological Survey, Sacramento, CA. Water Resources Div.
For primary bibliographic entry see Field 2D.
W83-02984

GEOLOGY AND GROUND-WATER RESOURCES OF OSWEGO COUNTY, NEW YORK,
Geological Survey, Ithaca, NY. Water Resources Div.
For primary bibliographic entry see Field 2F.
W83-02987

GROUND-WATER RESOURCES OF THE ARCADIA-MINDEN AREA, LOUISIANA,
Geological Survey, Baton Rouge, LA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W83-02991

HYDROLOGIC DATA OF THE LOWER MERRIMACK RIVER BASIN, MASSACHUSETTS, FROM CONCORD RIVER, LOWELL, TO PLUM ISLAND, NEWBURYPORT,
Geological Survey, Boston, MA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W83-02994

ASSESSMENT OF ECONOMIC, SOCIAL, AND INSTITUTIONAL IMPACTS OF GROUNDWATER REGULATION OF THE TILLMAN TERRACE AQUIFER IN SOUTHWESTERN OKLAHOMA,
Oklahoma State Univ., Stillwater. Dept. of Geology.
D. C. Kent, H. P. Mapp, and J. W. Westphal.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-206805, Price codes: A10 in paper copy, A01 in microfiche. Water Resources Research Institute Completion Report, Oklahoma State Univ., Stillwater, March 1983. 210 p, 22 Fig, 74 Tab, 6 Append. OWRT A-093-OKLA(2), 14-34-0001-0138.

Descriptors: *Groundwater irrigation, *Economic prediction, *Linear programming, *Numerical analysis, *Public opinion, *Political aspects, Computer models, Groundwater management, Water law, Social impact, Economic impact, Model studies, *Oklahoma, Tillman Terrace aquifer.

The purpose of this project is to assess the economic, polital, legal and social impacts of groundwater regulation in Tillman County, Oklahoma. The assessment makes use of a mathematical model developed for the computer by the U.S. Geological Survey and modified for use as a means to determine the amount of ground-water allocation from the Tillman Terrace aquifer in Oklahoma. Interpretation of ground-water law in Oklahoma is used as the basis for determining model design scenarios. Two scenarios are considered: (1) existing pumping projected to 1993 and (2) additional pumping after 1983. A constant annual pumping rate of 1 ac ft/ac, which is based on the current ground-water allocation, is used for both scenarios. Results of the aquifer model simulation runs for the two scenarios are used in a separate economic linear optimization model in order to consider economic impact of aquifer depletion between 1983 and 1993. Irrigated and dryland crop patterns and commodity prices are used in conjunction with the model prediction of water levels and well yield. Social implications related to ground-water depletion between 1983 and 1993 are based on field surveys and results of the economic analysis. An assessment is also made for the legal and institutional constraints needed to regulate and manage the aquifer with respect to economic predictions in the study.
W83-03033

USE OF GEOLOGIC AND WATER YIELD DATA FROM GROUND WATER BASED COMMUNITY WATER SYSTEMS AS A GUIDE FOR GROUND WATER PLANNING AND MANAGEMENT,
North Carolina State Univ. at Raleigh. Dept. of Marine, Earth and Atmospheric Sciences.
C. W. Welby, and T. M. Wilson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-208314, Price codes: A07 in paper copy, A01 in microfiche. Water Resources Research Institute Report No 184, North Carolina State Univ., Raleigh, August 1982. 111 p, 16 Fig, 21 Tab, 37 Ref, 4 Append. OWRT A-120-NC(1), 14-34-0001-1135.

Descriptors: *Well Yield, *Geohydrology, *Groundwater availability, *Groundwater management, Specific capacity, Geologic fractures, Crystalline rocks, Petrology, Low flow, Groundwater recharge, Stream discharge, Land use, Topography, *North Carolina, Wake County, Data collections, Well data.

Data from 214 wells in the Community Well System of Wake County, North Carolina provided information on groundwater availability that should be valuable in land-use planning. Well yield data are used to identify favorable and unfavorable areas for groundwater development, and probability curves are used to estimate yields of wells in a given rock type. A two-media system was recognized, consisting of the saprolite and the fractured crystalline bedrock. Characteristics of the fracture system (frequency, size and interconnection) are the most important variables affecting well production. Lithology is the second most important factor. The highest average yield occurs in wells in the injected gneiss and schist, the lowest average yield in mica gneiss and schist, and intermediate yields in granite and in felsic gneiss and in felsic gneiss and schist. Specific capacity was found to be a better parameter than yield for comparing the water bearing capacities of individual well sites. Low stream flow values (7-day, 10-year; 7-day, 1-year) are used to estimate usable groundwater recharge. Planning considerations are discussed, as are reasons for well failures.
W83-03046

WELL RECHARGE IN IDEALIZED RECTANGULAR AQUIFERS,
Thessaloniki Univ., Salonika (Greece). Dept. of Hydraulics.
P. Latinopoulos.
Advances in Water Resources, Vol 5, No 4, p 233-235, December, 1982. 3 Fig, 1 Tab, 6 Ref.

Descriptors: *Aquifer recharge, *Recharge wells, *Mathematical equations, Aquifer characteristics, Aquifers, Wells.

Analytical solutions for groundwater flow in rectangular aquifers are presented in the case of a single well recharge. The problem concerns the impact of a seasonal recharge scheme of variable duration on aquifers with various boundary conditions. The results obtained from these idealized aquifers can be used in a preliminary assessment of the groundwater response to artificial recharge schemes. Among the goals of an artificial recharge scheme is storage augmentation and river regulation, for example, low flow supplementation. Since the natural inputs and outputs of an aquifer vary seasonally, the efficient way of using artificial recharge should be such that deficiencies during the dry period of a year could be beneficially supplemented from surplus water added artificially during the wet period. However, the dry and wet periods are repeated almost consecutively year after year, so a reasonable approach to operating any recharge system is to run it under an annual periodicity. The flow is assumed to take place through an idealized aquifer, rectangular in shape, which is non-leaky, homogeneous with respect to storage, and homogeneous and isotopic with respect to transmissivity. The analytical solutions for

the two-dimensional aquifer recharge are of great help in deriving prelimimary estimates of the future consequences from artificial recharge schemes. (Baker-FRC)
W83-03056

OPENING OF A FAULT AND RESULTING SLIP DUE TO INJECTION OF FLUID FOR THE EXTRACTION OF GEOTHERMAL HEAT,
Tohoku Univ., Sendai (Japan). Dept. of Mechanical Engineering.
K. Hayashi, and H. Abe.
Journal of Geophysical Research, Vol 87, No B2, p 1049-1054, February 10, 1982. 4 Fig, 1 Tab, 12 Ref.

Descriptors: *Geothermal studies, *Injection, *Hydraulic fracturing, Geologic fissures, Thermal water, Model studies, Heat flow, Friction.

A reservoir filled with heat exchange fluid is necessary to extract heat from hot dry rock masses. The behavior of a fault with a fluid-filled region is studied by mathematical models. The fault is described as a prefractured plane in the earth's crust and is modeled by an interface across which two elastic bodies contact each other, where frictional forces against the relative movement between the two surfaces of the interface are considered. When fluid is injected between the surfaces, the fault opens up in the region where the pressure acting on the fault plane before the injection is locally smaller than that on neighboring regions. The slip of surfaces caused by reduction of frictional forces due to fluid injection is analyzed by two models: an interface with frictional resistance only and an interface with both frictional resistance and fracture toughness. The size of the slipped region was not significantly different from the dimensions of practical interest. (Cassar-FRC)
W83-03132

APPLICATION OF LINEAR SYSTEMS THEORY AND LINEAR PROGRAMMING TO GROUND WATER MANAGEMENT IN KANSAS,
Kansas State Geological Survey, Lawrence.
M. Heidari.
Water Resources Bulletin, Vol 18, No 6, p 1003-1012, December, 1982. 5 Fig, 2 Tab, 20 Ref.

Descriptors: *Groundwater management, *Wells, *Pumpage, Model studies, Pawnee Valley, *Kansas, Linear Systems Theory, Linear programming, Water table, Appropriation.

A groundwater management model based on the use of linear systems theory and linear programming has been developed. It can calculate the best pumpage policies subject to physical and institutional constraints. The validated model is applied to the Pawneee Valley, Kansas, region, using 61 hypothetical well fields for 2 periods, 5 or 10 years. For the 5-year period, 2 types of optimal pumpage policies are generated: with and without net appropriation as a constraint. For the 10-year period, 2-year optimal pumpage policies are generated using 25% of the saturated thickness without net appropriation as a constraint. About 50% of the 1979 net appropriation may be satisfied (32,318 acre ft per year). This study concludes that the groundwater resources of the Pawnee Valley are highly overappropriated. There seems to be no possibility that the 1979 net appropriation of 64,018 acre ft may be pumped from the aquifer for a long time. At best 40,000-50,000 acre ft per year may be pumped in 5 years and 30,000-35,000 acre ft per year may be pumped over the next 10 years if 25% of the saturated thickness is allowed to be used up. (Cassar-FRC)
W83-03142

4C. Effects On Water Of Man's Non-Water Activities

CHANGES IN MARSH AREA ALONG THE CANADIAN SHORE OF LAKE ONTARIO,
Toronto Univ. (Ontario). Inst. for Environmental Studies.
T. H. Whillans.
Journal of Great Lakes Research, Vol 8, No 3, p 570-577, 1982. 6 Fig, 2 Tab, 29 Ref.

Descriptors: *Marshes, *Maps, *Urbanization, Wetlands, *Lake Ontario, Shores, Coastal marshes, Land development, *Canada.

Losses of marsh area were studied on the Canadian shoreline of Lake Ontario from the Bay of Quinet west to the Niagara River. Maps dated 1789 to 1962 established a baseline marsh area of 11,138 acres. Net losses for 62 marshes were estimated at 4745 acres or 43% of the baseline area, as determined by comparison with 1977-79 maas. Losses were highest in heavily settled areas such as Toronto (York County), and Peel, Wentworth, and Niagara Counties. In the eastern section of the studied shoreline losses were 4-27%. The method has some difficulties which limit its usefulness: lack of standardization, a focus on emergent vegetation, and difficulties in interpreting old maps. However, it is suitable for rough approximations and for use with other methods. (Cassar-FRC)
W83-03076

THE IMPACT OF ENERGY DEVELOPMENT IN THE TONGUE RIVER BASIN, SOUTHEASTERN MONTANA,
Ohio Wesleyan Univ., Delaware. Dept. of Geography and Geology.
D. H. Hickcox.
Water Resources Bulletin, Vol 18, No 6, p 941-948, December, 1982. 4 Fig, 2 Tab, 18 Ref.

Descriptors: *Coal mining, *Groundwater pollution, *Water allocation, Mine drainage, Strip mines, Tongue River, *Montana, Water quality, Water level, Wells, Aquifers, Water pollution sources, Water rights, Energy.

Rapid development of coal deposits in Montana's Tongue River Basin has significantly affected the hydrologic systems in the region. The 150 mi long, 50 mi wide basin currently has four coal mines, including the Decker Coal Company, one of the largest in the U.S. There, mining is concentrated on a 53-ft thick seam of subbutuminous coal, which is strip mined. The mine cut intercepts the aquifer and has stimulated lateral groundwater flow toward the mine and vertical flow from a coal bed to an overlying coal bed. Groundwater flow is now from the Tongue River reservoir toward the mine. Well levels have declined > 20 ft within 3/4 mile, 10 ft within 1.75 mile southwest of the mine, and 10 ft 1.5 mile northwest of the mine. By 1974 the rate of decline diminished, suggesting that systems were approaching equilibrium. Mine spoil leachates have increased levels of sodium, bicarbonate, and sulfate in groundwater. Surface water guality has also degenerated. Higher levels of dissolved solids and suspended sediments are apparent. Present water allocation favors agriculture, municipalities, and instream uses. Future coal mine development in this area may be constrained by water supplies. (Cassar-FRC)
W83-03139

4D. Watershed Protection

SOIL CONSERVATION IN THE COON CREEK BASIN, WISCONSIN,
California Univ., Los Angeles. Dept. of Geography.
S. W. Trimble, and S. W. Lund.
Journal of Soil and Water Conservation, Vol 37, No 6, p 355-356, November/December, 1982. 3 Fig, 1 Tab, 10 Ref.

Descriptors: *Soil conservation, *Erosion control, *Sedimentation rates, Soil management, Soil erosion, Cook Creek, *Wisconsin, Land management, Land use, Conservation.

Soil conservation measures appeared to be responsible for the significant declines in erosion and sedimentation rates from 1934 to 1975 in the Coon Creek Basin, Wisconsin. Average annual erosion rates on upland fields, computed from the Universal Soil Loss Equation, were 3000 metric tons per sq km in 1934 and 720 metric tons per sq km in 1975. Annual sedimentation rates, as determined by accumulation rates in small reservoirs, were 4800 metric tons per sq km of drainage area in 1936-45 and 55 metric tons per sq km in 1962-75. Sedimentation rates determined by deposition rates in the main valley were similar. Erosion and sedimentation were functions of erosive land use, an index of land use and land treatment, but there was a time lag of 10 to 40 years, increasing downstream. Although the total crop acreage did not change greatly over the years, conservation practices improved. These included contour plowing, contour stripcropping, long ratation, crop residue management, cover crops, improved fertilization, and controlled grazing. (Cassar-FRC)
W83-02827

SHORE PROTECTION IN THE TOWN OF STONEY CREEK, SOUTHWEST LAKE ONTARIO, 1934-1979: HISTORICAL CHANGES AND DURABILITY OF STRUCTURES,
Guelph Univ. (Ontario). Dept. of Geography.
R. G. D. Davidson-Arnott, and H. I. Keizer.
Journal of Great Lakes Research, Vol 8, No 4, p 6350647, 1982. 10 Fig, 1 Tab, 12 Ref.

Descriptors: *Shoreline protection, *Lake shores, *Erosion control, Groynes, Sea walls, Protection, Water level fluctuations, Stoney Creek, Ontario, *Lake Ontario, Rubble, Construction, Beach erosion, Wave action.

Shore protection measures used by private property owners were studied in a 10 km stretch of shoreline at Stoney Creek on western Lake Ontario. Average rates of recession are > 1 m per year in the silty-clay till. Between 1934 and 1979 the proportion of protected shoreline increased from 20% to 64% (from 58 to 388 structures). About 60% of properties are protected by seawalls and/or groynes. Groynes of various materials were more popular before 1972, and concrete seawalls were more popular before 1972, and concrete seawalls were more popular after that date. An average of 71% of structures are damaged or destroyed within 10 years of construction and 87% within 20 years. Groynes have been slightly more durable than seawalls and rubble. The general low durability is a result of poor design and construction of the structures, lack of cooperation among property owners, and unsuitable physical factors such as high waves driven by northeast storms. During periods of low lake levels (1954-65) destruction of property and building of protective structures were considerably less than in higher water periods such as 1972-74, when 43% of all structures were damaged or destroyed each year. The economic benefit of shore protection measures in this community are questionable. Effective remedial measures would be very expensive. Although it is possible to increase the effectiveness and durability of protective structures, the scenic and recreational quality of the shoreline would be adversely affected. The problem of easily eroded till increases the difficulties of a structural solution to the erosion problem. (Cassar-FRC)
W83-02842

HYDROLOGICAL AND ENVIRONMENTAL CONTROLS ON WATER MANAGEMENT IN SEMIARID URBAN AREAS -- PHASE II,
Arizona Water Resources Research Center, Tucson.
S. D. Resnick, K. J. DeCook, and R. A. Phillips.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-202382, Price codes: A16 in paper copy, A01 in microfiche. Water Resources Research Center Completion Report, March 1983. 355 p, 58 Fig, 64 Tab, 58 Ref, 5 Append. OWRT B-023-ARIZ(7), 14-34-0001-3556.

Descriptors: *Urbanization, *Semi-arid areas, *Rainfall-runoff relationships, Water quantity, Water quality, Rainfall, *Storm runoff, Economic feasibility, artifical recharge, Water resources planning, Urban watersheds, *Arizona, Tucson, Institutional constraints, Legal aspects, Social aspects.

Rainfall and runoff studies initiated by the University of Arizona provide data for three small urban watersheds from 1968 and one rural watershed from 1957 to 1969. Annual precipitation of about 11 inches produces annual runoff ranging from 0.44 inches in depth for the rural watershed and 1.10 to 2.10 inches for the urban watersheds. There is about a four to five-fold increase in average yearly storm runoff volume with unbanization in the Tucson area. Water samples collected on a lumped basis show generally high concentrations of suspended sediment, bacterial loading, and dissolved organics. Initial field treatment and exploratory laboratory studies of treatment methods indicate that three days is an optimal length of concentrations. Multi-purpose urban storm runoff management systems can be developed to control floods while at the same time maintaining water-based linear parks along minor stream channels in semiarid regions. Multi-purpose systems are more economical than the single-purpose systems required to accomplish the same purposes. Further studies are needed to characterize the quality of storm runoff from selected urban land use areas with a view toward on-site control and disposal. W83-02918

OVERLAND FLOW FROM SLOPING LAND: EFFECTS OF PERCHED WATER TABLES AND SUBSURFACE DRAINS,
Oregon State Univ., Corvallis. Agricultural Experiment Station.
For primary bibliographic entry see Field 4A.
W83-03028

EFFECTS OF FARMING PRACTICES ON SEDIMENT IN IRRIGATION RETURN FLOW,
Washington State Univ., Pullman. Dept. of Agricultural Engineering.
L. G. King, and A. C. Janke.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-206862, Price codes: A06 in paper copy, A01 in microfiche. Water Research Center Completion Report, Washington State Univ., Pullman, March 1983. 91 p, 8 Fig, 11 Tab, 23 Ref, 1 Append. OWRT B-067-WASH(2), 14-34-0001-7197

Descriptors: *Irrigation return flow, Irrigation tailwater, Sediment, Sediment basins, Furrow irrigation, Irrigation efficiency, *Washington, Soil erosion, Sulphur Creek drainage basin, Cultivation.

The overall objective of the research was to assist in determining the success of the Sulphur Creek Demonstration Project in reducing sediment in irrigation return flow by changing farming practices on irrigated lands. Although this demonstration project was terminated prematurely by the agencies conducting it, some valuable results were obtained. It was determined that a small percentage of irrigators cause a large fraction of the sediment content of irrigation return flows. For fourteen different sites, only three in 1977 and four in 1978 had net seasonal sediment loss in excess of 3 tons/acre. Studies of field performance of sediment basins gave valuable information on the particle size distributions of sediment in irrigation tailwater and the load of sediment carried by tailwater under various field and crop conditions. These latter two types of data are almost non-existent and yet very necessary for proper design of sediment basins. Procedures were developed and tested to provide irrigators with tools for evaluation of their irrigation practices. If properly applied, these procedures can determine whether for given field conditions, changes in water management to control sediment discharge are possible or whether a change in the irrigation system is necessary.
W83-03039

SEDIMENTATION AND ITS CONTROL IN NADIS IN THE INDIAN ARID ZONE - A CASE STUDY,
Central Arid Zone Research Inst., Jodhpur (India).
For primary bibliographic entry see Field 2J.
W83-03133

URUGUAY'S SAVE OUR SOILS CAMPAIGN.
World Water, Vol 5, No 8, p 22-23, 25, August, 1982.

Descriptors: *Erosion, *Soil management, *Uruguay, Agriculture, *Soil erosion, Soil water, Water management, Irrigation, Soil conservation, Erosion control.

Improved water and soil management practices are being encouraged by Uruguay's Ministry of Agriculture and Fisheries through its Directorate of Water Use and Management. About 90% of the country's total land area is under cultivation. As a result of outdated soil management and irrigation practices, heavy precipitation, and rapid evaporation, soil depletion and erosion are becoming serious problems. Pilot projects for demonstrating suitable irrigation and erosion control methods have been established in five different areas of the country. At these sites, varying in soil types, topography, and agricultural systems, information on local soil and cultivation is collected. Soils are wet to excessively wet, depending on depth, from April through September. By November the superficial soils have lost 75% of their moisture retention capacity. Lowest water content is seen in February. The water deficits are especially detrimental to growth of pasture grasses. Each year about 150 trained agronomists begin work with government and private agricultural concerns. (Cassar-FRC)
W83-03134

5. WATER QUALITY MANAGEMENT AND PROTECTION

THE USE OF MATHEMATICAL MODELS IN THE FORMULATION OF POLLUTION CONTROL POLICIES - AN OVERVIEW,
National Inst. for Water Research, Pretoria (South Africa).
A. Gerber.
Water Science and Technology, Vol 14, No 9-11, p 1045-1053, 1982. 3 Ref.

Descriptors: *Water pollution control, *Mathematical models, Model studies, Mathematical studies, Planning, Policy making.

Principles underlying the development of mathematical models are outlined in non-mathematical terms. Some of the advantages and limitations of computer models are highlighted, especially ways in which models may be misused. The skills required for effective modelling are sketched, as are major problem areas hampering the general application of models. The development and use of models involve several interrelated areas such as system conceptualization, model selection, data collection design, computer program use, history matching and prediction. When dealing with real systems a model is never exact, and complete data are never available; therefore use is an iterative process, to which one never achieves a final solution. Use of numerical models requires the model developer to determine and resolve data inadequacies, aids in conceptualizing system behavior, provides a means for solving extremely complex water-related problems, and provides through the computer code and data deck used a perfect record and means for transfering information as to how a problem was solved. (Baker-FRC)
W83-02864

5A. Identification Of Pollutants

ELIMINATION OF THE CHLORIDE INTERFERENCE IN THE DETERMINATION OF THE COD (BESEITIGUNG DER CHLORID-STORUNG BEI DER BESTIMMUNG DES CSB),
Stuttgart Univ. (Germany, F.R.). Inst. fuer Siedlungswasserbau, Wasserguete- und Abfallwirtschaft.
R. Wagner, and W. Ruck.
Zeitschrift fuer Wasser und Abwasser Forschung, Vol 14, No 4, p 145-151, August, 1981. 9 Fig, 3 Tab, 29 Ref. English summary.

Descriptors: *Chemical oxygen demand, *Chlorides, Oxidation, Water analysis, Chemical analysis, Measurement techniques.

Although chloride ions do not influence the oxygen balance of natural waters, they are oxidized by dichromate in tests for chemical oxygen demand (COD). Three methods for overcoming this interference in COD testing are discussed: 1) quantitative oxidation of chloride ions to chlorine, under specified precautions, and correction of the results of the analysis for the calculated amount of oxidizing agent needed for this reaction; 2) use of mercuric sulfate as a sequestering agent for chloride ions; and 3) elimination of the chloride ions from the sample prior to the oxidation step through formation of hydrogen chloride by diffusion in a closed chamber to avoid losses of volatile oxidizable constituents. Results of kinetic investigations of the third option are presented. This method can be used to improve the determination of COD levels, enhancing the use of COD measurement in process control. (Author's abstract)
W83-02814

THE MEASUREMENT OF TOTAL PHOSPHORUS IN WASTE WATER (LE DOSAGE DU PHOSPHORE TOTAL DANS LES EAUX USEES),
Agence de Bassin Rhone-Mediterranee-Corse (France).
M. Bonnefille, R. Dugas, D. Peyre, and A. Tabonet.
Techniques et Sciences Municipales, No 5, p 301-306, May, 1981. 2 Fig, 6 Tab, 8 Ref. (No English Summary).

Descriptors: *Phosphorus, *Wastewater analysis, *Chemical analysis, Colorimetry, Mineralization, Sample preparation, Spectrophotometry, *Pollutant identification.

A method is proposed for the measurement of total phosphorus in domestic and industrial waste waters containing organic materials. The method involves the transformation of organic and inorganic phosphorus into orthophosphate ions for measurement using the French standard (AFNOR) procedure. Mineralization of the sample is accomplished by boiling in contact with air in the presence of sulfuric acid and ammonium persulfate for 1 hr after appearance of white fumes. Following addition of the detection reagent, the color produced is read at a wavelength of 880 nm, or less preferably 700 nm, within 10-20 min. The pH of the solution read in the spectrophotometer must be from 2 to 7, and the reagent blank reading must be subtracted. Potassium and ammonium ions interfere in the orthophosphate determination, while sodium and sulfate interfere only at higher levels. The analytical procedures also include precautions with respect to phosphorus impurities in some reagents. When a 50 ml sample is used, the limit of detection is about 0.2 mg of phosphorus per liter, with a reproducibility of about 5%. (Carroll-FRC)
W83-02816

DETERMINATION OF THE COLOUR OF WATER AND WASTE WATER (BESTIMMUNG DER FARBIGKEIT VON WASSERN),
Stuttgart Univ. (Germany, F.R.). Inst. fuer Siedlungswasserbau, Wasserguete- und Abfallwirtschaft.
R. Wagner, and W. Ruck.
Zeitschrift fuer Wasser und Abwasser Forschung, Vol 14, No 4, p 152-154, August, 1981. 2 Fig, 2 Tab, 5 Ref. English Summary.

Descriptors: *Spectral analysis, *Color, Optical properties, Water properties, Physical properties, Wastewater analysis, Water analysis, Spectrophotometry, *Pollutant identification.

Methods C1 and C3 of the German Standard Methods for the Examination of Water, Waste Water, and Sludge define spectral absorption coefficients for special wavelengths. This paper suggests that the color of water and wastewater be characterized in a quantitative sense using the mean value of the spectral absorption coefficient in the range of visible light. The practical measuring

range--from clean surface water to wastewater from the textile industry--covers about three orders of magnitude and can be accommodated by commonly used photometric laboratory equipment. A standard for color is presented. The mean spectral absorption coefficient is an additive parameter, which may be supplemented by the recorded absorption spectrum for more qualitative considerations. The spectral absorption coefficient is easier to determine than the ADMI color value, proposed by the American Dye Manufacturers Institute for the same purpose, although there appears to be some relationship between these two parameters. (Author's abstract)
W83-02819

SOLUBLE REACTIVE PHOSPHORUS MEASUREMENTS IN LAKE MICHIGAN: CAUSES OF METHOD-SPECIFIC DIFFERENCES,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
S. J. Taraspchak, R. L. Chambers, and S. M. Bigelow.
Journal of Great Lakes Research, Vol 8, No 4, p 100-110, 1982. 1 Fig, 7 Tab, 34 Ref.

Descriptors: *Phosphorus, *Phosphates, *Pollutant identification, Soluble reactive phosphorus, *Lake Michigan, Ammonium molybdate, Grand River.

Three methods for determining soluble reactive phosphorus (SRP) were compared, using lake water samples from Lake Michigan and the Grand River. Harvey's method, the ascorbic acid method, and the Chamberlain-Shapiro extraction technique differed in acid strength, exposure time, and ammonium molybdate concentration. Longer exposure times (Harvey and ascorbic methods, 9 min) often resulted in higher SRP values. More phosphate-P was released from bound sources in lake water with 0.16 N HC1 (extraction method) than with 0.4 N HC1 (Harvey method). The discrepancies among methods were not proportional to variations in acid strength, exposure time, and molybdenum concentration but were related to differences in chemical composition of the SRP pool. Data generated by the different methods cannot be validly compared. In general, Harvey's method gave higher values than the ascorbic acid method. (Cassar-FRC)
W83-02821

A SIMPLIFIED SCHEME FOR THE ANALYSIS OF POLLUTANTS IN GROUNDWATER AND LEACHATES CONTAMINATED BY HAZARDOUS CHEMICALS,
Missouri Univ.-Columbia. Dept. of Chemistry.
S. E. Manahan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-196667, Price codes: A04 in paper copy, A01 in microfiche. ater Resources Research Center Completion Report, Univ. of Missouri, Columbia, September, 1982. 56 p, 36 Fig, 4 Tab, 9 Ref. OWRT A-133-MO(1), 14-34-0001-2127.

Descriptors: *Hazardous wastes, Gas chromatography, Total organic carbon analysis, *Pollutant identification, *Water analysis, Groundwater, Leachates, Coal, Pollutant analysis, Coal gasification.

The overall objective of the research was the development of a solvent-based separation procedure for the fractionation of organic pollutants from a hazardous waste source in water into hydrophilic; insoluble (suspended); and organophilic acid, base, and neutral fractions. The fractions may be characterized at the simplest level by dissolved organic carbon analysis, leaving open the option for more sophisticated gas chromatographic and gas chromatographic/mass spectrometric analysis. The separation and analysis procedures have been proved on a variety of organic compounds obtained as by-products of underground coal gasification.
W83-02904

REAERATION RATE ESTIMATION USING THE LAG IN DISSOLVED OXYGEN CONCENTRATION,
Louisiana State Univ., Baton Rouge. Inst. for Environmental Studies.
M. G. Waldon.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-202341, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Institute Completion Report, Louisiana State Univ., Baton Rouge, January 1983. 32 p, 4 Fig, 4 Tab, 10 Ref. 1 Append. OWRT A-054-LA(1), 14-34-0001-1120.

Descriptors: *Reaeration coefficient, Reaeration, *Dissolved oxygen, Productivity, Parameter estimation, *Peak lag method.

Estimation of the reaeration coefficient in a stream may be classified as a dynamic system parameter estimation problem. One classical method of parameter estimation widely used in other fields involves observation of the output of a system being 'forced' by a sinusoidal input signal. In some cases the system parameters may be estimated by simply observing the lag of the output to the input signal at one or more input frequencies. This classical method is here applied to the estimation of the reaeration coefficient. In this case, the forcing function or input is the diel production and consumptive of oxygen through photosynthesis and respiration. This function is assumed to be symmetrical and to peak at local true solar noon. A proposed relationship provides an estimate of the rearation coefficient based on the timing of the afternoon maximum of dissolved oxygen and the day length. This method, termed the 'Peak Lag Method', is derived and tested, and an extension is proposed which allows analysis of data from multiple stations along a stream. It is concluded that under some conditions the peak lag method provides an acceptable alternative to other estimation techniques.
W83-02914

THE MEASUREMENT OF COMPLEXATION CAPACITY AND CONDITIONAL STABILITY CONSTANTS FOR LIGANDS IN NATURAL WATERS,
Procter and Gamble Co., Cincinnati, OH.
T. A. Neubecker, and H. E. Allen.
Water Research, Vol 17, No 1, p 1-14, January, 1983. 5 Tab, 98 Ref.

Descriptors: *Metals, *Speciation, *Chelation, Fate of pollutants, Reviews, Organic matter, *Pollutant identification, Solubilization, Bioassay, Ion exchange, Voltammetry, Ion-selective electrodes, *Ligands.

The important factors controlling the speciation of metals in solution are reviewed, and the techniques used for measuring metal complexation in natural waters are discussed. The effects of inorganic species such as carbonate, chloride, or phosphate on metal speciation are readily characterized. The action of organic ligands, which occur in infinite variety, is less easily determined. Natural organic matter, such as humic and fulvic acids, accounts for most of the organic substances in surface waters. Some computer models for metal speciation exclude organic matter because of its assumed negligible role in complexation. Several methods available for determining metal speciation have limitations. These include ion-selective electrodes, biological techniques, solubility measurements, ion exchange, and voltammetry. Despite limitations, a combination of ion exchange and voltammetry is popular. Some miscellaneous methods include metal ion catalysis of oxidation-reduction reactions, Chelex 100 resin, gas filtration, dialysis, and fluorescence quenching. The complexation capacity is defined by the type of measurement and the reference metal. Therefore, there is a need for extensive intercomparison of methods. (Cassar-FRC)
W83-02957

HYDROLOGIC CHARACTERISTICS OF SURFACE-MINED LAND RECLAIMED BY SLUDGE IRRIGATION, FULTON COUNTY, ILLINOIS,
Geological Survey, Urbana, IL. Water Resources Div.
G. L. Patterson, R. F. Fuentes, and L. G. Toler.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-124982, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 82-16, August 1982. 30 p, 16 Fig, 7 Tab, 20 Ref.

Descriptors: *Land reclamation, *Strip mines, *Water quality, *Hydrologic data, Networks, Monitoring, Sludge, Surface water, Strip mine lakes, Sediment discharge, Groundwater, Water table, *Illinois, Fulton County.

Analyses of water samples collected at four stream-monitoring stations, in an area surface mined for coal and being reclaimed by sludge irrigation, show the principal metals are sodium, calcium, and magnesium and principal non-metals are chloride, sulfate, and bicarbonate. Comparing yearly mean chemical concentrations shows no changing trends since reclamation began, nor are there differences between stations upstream and downstream from the site. Yearly suspended-sediment loads and discharge relations upstream and downstream from the site also show no differences. Discharge hydrographs of two streams draining the site show a delayed response to precipitation due to the storage capacity of several upstream strip-mine lakes. The water-table surface generally follows the irregular topography. Monthly water-level fluctuations were dependent on the surface material (mined or unmined) and proximity to surface discharge. The largest fluctuations were in unmined land away from discharge while the smallest were in mined land near discharge. The water table is closer to the surface in unmined land. Analyses of water samples from 70 wells within or adjacent to the reclamation site showed no differences in water quality which could be attributed to sludge or supernatant application. Samples from wells in mined land, however, had higher concentrations of dissolved sulfate, calcium, magnesium, chloride, iron, zinc, and manganese than samples from wells in unmined land. (USGS)
W83-02975

HYDROLOGIC DATA OF THE LAKE COCHITUATE DRAINAGE BASIN, FRAMINGHAM-NATICK, MASSACHUSETTS,
Geological Survey, Boston, MA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W83-02989

ATYPICAL MYCOBACTERIA ISOLATED AT CATANIA (MICROBATTERI ATIPICI ISOLATI A CATANIA),
Catania Univ. (Italy). Cattedra di Dermatologia Pediatrica.
M. Marranzano, B. Guarneri, M. Biondi, S. Sciacca, and G. Leonardi.
Igiene Moderna, Vol 77, No 2, p 317-324, 1982. 5 Tab, 12 Ref. English summary.

Descriptors: *Mycobacteria, Swimming pools, Aquariums, Bacteria, *Aquatic bacteria, Pathogenic bacteria, Epidemiology, Public health, Human diseases, *Italy, Catania.

A study was undertaken to determine the mycobacteria found in swimming pools and aquariums in Catania, Italy and to determine whether persons having contact with these sources experienced skin infections as a result. The following mycobacteria were isolated in waters taken from swimming pools in use in Catania: M. gordonae, M. triviale, M. smegmatis, and M. fortuitum. Aquariums in private homes and pet shops in Catania were found to have M. kansasii, M. gordonae, M. terrae, M. smegmatis, M. fortuitum, and M. chelonei. No case of skin infection was noted in any person using the swimming pools, nor were there any recorded cases of skin infection from these sources in the lists of outpatients at the Dermatological Clinic of the University of Catania (a total of 10,613 patients over a 4-year period). (Author's abstract)
W83-03009

A SAPONIFICATION PROCEDURE FOR THE DETERMINATION OF SOME CHLORINATED HYDROCARBONS IN FISH,

Michigan Univ., Ann Arbor. Dept. of Environmental and Industrial Health.
M. S. Simmons, J. A. Sweetman, T. J. Miller, and D. J. Jude.
Journal of Great Lakes Research, Vol 8, No 3, p 587-589, 1982. 3 Tab, 6 Ref.

Descriptors: *Pesticide residues, *Fish, *Chlorinated hydrocarbons, *Pollutant identification, *Saponification, Polychlorinated biphenyls, Lake Huron, Whitefish, Aldrin, Dieldrin, DDT, Endrin, Organic compounds, Aromatic compounds.

A rapid method for determination of chlorinated hydrocarbon residues in fish involves saponification with alcoholic potassium hydroxide and chromatography on activated silica gel columns with petroleum ether and diethyl ether eluates, followed by gas chromatography equipped with electron-capture detection. Recoveries of aldrin, DDT and metabolites, polychlorinated biphenyls (PCB), dieldrin, and endrin were 82-94%. Pesticide residues in Lake Huron round whitefish were: PCB, 0.130-1.89 ppm: DDT and metabolites, 0.018-0.76 ppm; aldrin, 0.002-0.040 ppm; and dieldrin, none detected to 0.016 ppm. The method is not applicable to lindane, chlordane, heptachlor, and toxaphene, because these compounds dehydrohalogenate during the saponification step. (Cassar-FRC)
W83-03077

SOLUBLE REACTIVE PHOSPHORUS MEASUREMENTS IN LAKE MICHIGAN: FILTRATION ARTIFACTS,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
S. J. Tarapchak, S. M. Bigelow, and C. Rubitschun.
Journal of Great Lakes Research, Vol 8, No 3, p 550-557, 1982. 4 Tab, 25 Ref.

Descriptors: *Lakes, *Water analysis, *Phosphorus, *Filtration, Measuring instruments, *Lake Michigan, Great Lakes, Filters, *Pollutant identification.

A preliminary study was undertaken to evaluate the importance of filtration artifacts in soluble reactive phosphorus (SRP) estimation using water from southern Lake Michigan. This report demonstrates that SRP estimates can be seriously biased by variations in filtration procedures, that release of molybdate reactive P04-P from abiotic particulate material can occur, and that filtration artifacts are partially responsible for method-specific differences in SRP estimation. Variations in vacuum pressure and filter pore size can bias estimates by approximately 100%, and variations in sample volume alone can produce nearly a twofold difference in SRP values. The best set of filtration conditions for SRP estimation cannot be specified from the analyses reported here. Leakage of molybdate-reactive P04-P from fragile organisms will vary seasonally depending on variations in their abundance and surplus P content. Similarly, reductions in SRP caused by filter clogging will vary with the amount of debris in the water and on the density and size of P-containing particles. For routine SRP estimation it is recommended that constant vacuum pressure and sample volumes be used along with the same filter type and size. (Baker-FRC)
W83-03084

ARTIFACTS AND LOSSES IN THE SAMPLING OF CHLORINATED WATERS BY XAD ADSORPTION,
American Univ., Washington, DC. Dept. of Chemistry.
A. M. Cheh.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-208843, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Research Center, University of the District of Columbia, Report No 45, April 1983. 58 p, 14 Fig, 4 Tab, 9 Ref. OWRT A-017-DC(1), 14-34-0001-2109.

Descriptors: *Water sampling artifacts, *Chlorination, *XAD resins, *Mutagens, *Ames assay, High performance liquid chromatography, Electrophiles, *Pollutant identification.

Chlorination of natural waters generates mutagens that most likely are electrophiles. These electrophiles are often recovered for testing and analysis by adsorption to XAD resins. It was found that the production of artifacts stemming from the action of free chlorine on XAD-4 resin could be suppressed at least ten fold by converting the free chlorine to chloramine. Kinetic studies indicate that free chlorine is consumed at least ten times as rapidly by XAD-4 as in chloramine. Sampling losses during XAD recovery of electrophiles and mutagens were also examined. Mutagenic activity bound to resins generally decreased over a period of several days, but some increases were seen. Electrophiles labeled by 4-nitrothiophenol generally decreased concurrently, but sometimes new species were seen. Organics concentrates in ethanol did not appear to lose mutagenic activity as rapidly as concentrates in DMSO. Simultaneous electrophile assays, however, indicated up to 50% loss of some electrophiles present in ethanol concentrates.
W83-03104

IDENTIFICATION OF TOTAL AND BIOLOGICALLY SENSITIVE FORMS OF TOXIC METAL INPUTS TO AN URBAN AFFECTED RIVER,
Washington Univ., Seattle. Fisheries Research Inst.
E. D. Thielk, and S. P. Felton.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-208850, Price codes, A04 in paper copy, A01 in microfiche. Publication No FRI-UW-8303, February 1983. 52 p, 15 Fig, 7 Tab, 39 Ref, 1 Append. OWRT A-116-WASH(1), 14-34-0001-1140.

Descriptors: Water pollution, *Heavy metals, *Copper speciation, Polarography, Pollution control, Complexing capacity, Complexometric titration, *Copper, Ligands, Reducible copper, Labile copper, *Pollutant identification, *Washington, Green River, *Voltammetry.

A need for inexpensive approaches for the determination of biologically available forms of copper has been established. Differential pulse anodic stripping voltammetry (DPASV) has been proposed as an inexpensive simple approach for these types of determinations. This study investigated copper speciation at six stations on the Green River, Washington, using DPASV. Measurements included total and DPASV reducible copper concentrations, DPASV complexing capacity of unidentified, naturally occurring ligands, and DPASV complexing capacity of specific copper ligands (PO sub 4, P sub 2 O sub 7, CO sub 3, glycine, citrate, oxalate, and EDTA). No endpoints to complexation reactions were observed for any sample. DPASV measurements in the presence of specific copper ligands demonstrated considerable dissociation of all complexes during deposition phase of the measurement, including copper-EDTA complexes. This phenomenon most likely resulted in determination of excessively high concentrations of reducible copper in river water, and may have accounted for low amounts of apparent complexation. The technical aspects of these measurements and sources of interference were discussed in terms of the data collected. It was concluded that the use of DPASV for making determinations of biologically available copper is limited.
W83-03105

MODIFIED STRIPPING TECHNIQUE FOR THE ANALYSIS OF TRACE ORGANICS IN WATER,
Linkoeping Univ. (Sweden). Dept. of Water in Environment and Society.
H. Boren, A. Grimvall, and R. Savenhed.
Journal of Chromatography, Vol 252, p 139-146, 1982. 9 Fig, 9 Ref.

Descriptors: *Organic compounds, *Trace levels, *Pulp and paper industry, *Pollutant identification, Gas chromatography, Motala River, *Sweden, Wastewater analysis, Water analysis, Fate of pollutants.

The closed loop stripping analysis for detecting trace organics in water was modified to increase the range of stripping temperature and flow rate of purging gas and to reduce problems of contamination. This modification, designated the straight and open system, involved shortening of tubing, substitution of stainless steel tubing with PTFE tubing, replacement of a glass frit with a glass capillary tube, change to an open loop system, and removal of trace organics in the nitrogen stripping gas by activated carbon adsorption. The modifications produced very few blank peaks in the subsequent gas chromatograms. The method was used to study trace organics in raw water from the Motala River, Sweden, a drinking water source, and in wastewater from municipal and pulp mill sources. Most of the organic compounds present (illustrated by chromatograms of the sesquiterpene fraction) in the water works supply were also present in the pulp mill wastewater. (Cassar-FRC)
W83-03131

MAXIMUM CONTAMINANT LEVELS FOR TOXIC SUBSTANCES IN WATER: A STATISTICAL APPROACH,
Wisconsin Univ.-Milwaukee. Dept. of Urban Planning.
G. W. Page, and M. Greenberg.
Water Resources Bulletin, Vol 18, No 6, p 955-963, December, 1982. 3 Fig, 6 Tab, 34 Ref.

Descriptors: *Water quality standards, *Statistical analysis, *Priority pollutants, Maximum contaminant levels, Standards, Carcinogens, Organic compounds, Pesticides, Cadmium, DDT, Above trace method, Outliers, Trace levels, *Pollutant identification.

The above Trace Method proved more satisfactory for establishing maximum contaminant levels (MCL) or nondegradation standards for toxic substances in water than two other methods, the half minimum method and the log-normal method. It is based on statistical outlier procedures which distinguish ubiquitous background levels of toxic substances from concentrations significantly greater than background. The Above Trace Method does not make assumptions about the true concentration of samples which have trace or nondetectable levels. However, it failed to detect any outliers (therefore failed to estimate MCL) for 17 of 42 toxic organic chemicals. Pesticide results were also inconsistent. Using data obtained from analyses of water samples, the method can calculate a conservative interim MCL suitable for protecting the public until data based on human health studies are available. Since the period between carcinogen exposure and resulting cancer can be 20-30 yr, it is likely that the human health statistics for the priority pollutants may not be available within 30 years. (Cassar-FRC)
W83-03145

5B. Sources Of Pollution

CONTENTS OF METALS AND SUSPENDED SOLIDS IN THE RHINE (METALLGEHALT UND SCHWEBSTOFFGEHALT IM RHEIN),
BASF A.G., Ludwigshafen am Rhein (Germany, F.R.).
K. -G. Malle, and G. Muller.
Zeitschrift fuer Wasser und Abwasser Forschung, Vol 15, No 1, p 11-15, 1982. 3 Fig, 4 Tab, 17 Ref. English summary.

Descriptors: *Suspended solids, *Heavy metals, Rivers, Bottom sediments, Suspended load, Copper, Chromium, Lead, Zinc, Mercury, Cadmium, *Rhine River, Fate of pollutants, *Federal Republic of Germany.

Metal and suspended solids concentrations in the Rhine at the German-Dutch border have been studied since 1973. The suspended solids content of the river has not changed significantly during this period. However, the concentrations of chromium, copper, zinc, cadmium, mercury, and lead are all declining. The decreases in the chromium and mercury concentrations are observed mostly as decreases in the concentrations of these metals in the

suspended solids, while zinc and cadmium concentrations have been reduced in the liquid phase. The metal concentrations in the river sediments largely coincide with the metal concentrations in the suspended solids. Although the Rhine carries an increased load of suspended solids when flow increases significantly, the transport of metals is not comparably increased during these events. Copper, zinc, and lead loads change distinctly with seasonal water flow changes, while chromium, cadmium, and mercury loads are relatively unaffected by seasonal changes. (Author's abstract)
W83-02813

HISTORY OF ACCIDENTAL POLLUTIONS WHICH HAVE OCCURRED IN THE WORLD (HISTORIQUE DES POLLUTIONS ACCIDENTELLES SURVENUES DANS LE MONDE),
A. Amezal, J. F. Bost, A. Guiraud, and Y. Merillon.
Techniques et Sciences Municipales, No 5, p 293-300, May, 1981. 5 Fig. (No English Summary).

Descriptors: *Water pollution control, *Water pollution prevention, *Water pollution sources, Pollutants, Accidents, Water pollution effects, *History.

Water distributors, the Regional Directorate for Equipment, and the Seine-Normandie Basin Authority have cooperated in conducting a study of cases of accidental water pollution occurring both in France and in other countries. Two approaches were taken in this study. The first was to identify and analyze the risks of accidental water pollution historically in both France and some industrialized countries. The second was to identify the sources of accidental pollution risks and means of limiting those risks. The effects of time of day, week, or year on the number of pollution accidents; the sources of pollution; the principal causes of pollution accidents, the principal pollutants involved in accidents; and the consequences of pollution accidents are discussed. Industries were found to be major sources of pollution accident risks. Hydrocarbons were the pollutants most often implicated, although pollution from chemical problems posed a greater threat to public health. While many of the recorded water pollution accidents had serious consequences, many could have been avoided and their consequences minimized through the implementation of simple and inexpensive measures. Those responsible for water quality should make prevention of water pollution accidents a major concern and should stress the application of measures needed to minimize pollution events. (Carroll-FRC)
W83-02817

METAL ION COMPLEXATION BY AQUATIC HUMUS. III. MODEL DEVELOPMENT AND RELATION TO SURFACE WATER. (KOMPLEXIERUNG VON METALLIONEN DURCH GEWASSERHUMINSTOFFE. III. MODELLENTWICKLUNG UND GEWASSERBEZUG),
Technische Univ., Munich (Germany, F.R.). Inst. fuer Wasserchemie und Chemische Balneologie.
F. H. Frimmel.
Zeitschrift fuer Wasser und Abwasser Forschung, Vol 14, No 1, p 7-10, February, 1981. 5 Tab, 27 Ref. English Summary.

Descriptors: *Decomposing organic matter, *Heavy metals, *Dissolved solids, Metals, Iron, Mercury, Copper, Molecular structure, Chemical reactions, Chemical properties, Flocculation, Humic substances, Fate of pollutants.

Although a realistic model of humic substances cannot be represented by a molecular structure, functional groups can be quantitatively determined. The properties of humic substances isolated from various waters were applied to a hypothetical compound having a molecular weight of 3,000. This compound was found to have between 11 and 15 sites suitable for protonation under conditions present in surface water. Between 4 and 9 equivalents of copper(II) could be complexed. Although strong coordination of iron(II,III) and mercury(II) was also possible, the number of sites suitable for such complexation was much smaller. Flocculation experiments with aerated brown water showed a significant decrease in dissolved metals and dissolved organic substances. These results, together with data on the the metal concentrations in unpolluted brown water and on the background values for fresh water, indicate that humic substances are of great importance for the dissolved metals content of water resources. Between 1 and 5 micromoles of heavy metals can be bound to humic materials at 1 milligram DOC. (Author's abstract)
W83-02818

MASS BALANCE MODELING OF HEAVY METALS IN SAGINAW BAY, LAKE HURON,
Environmental Research Lab.-Duluth, Grosse Ile, MI. Large Lakes Research Station.
D. M. Dolan, and V. J. Bierman, Jr.
Journal of Great Lakes Research, Vol 8, No 4, p 676-694, 1982. 14 Fig, 5 Tab, 28 Ref.

Descriptors: Metals, *Sediments, *Lake sediments, *Fate of pollutants, *Heavy metals, Zinc, Copper, Cadmium, Lead, Saginaw Bay, *Lake Huron, Model studies, Suspended sediments, Adsorption, Sedimentation, Wind-driven currents, Particulate matter, Path of pollutants.

A spatially segmented dynamic mass balance model was developed to describe the concentration of metals (cadmium, copper, lead, and zinc) and suspended solids in the water column and sediment of Saginaw Bay, Lake Huron. About 20,000 data points were obtained at 30 stations during 37 cruises in 1976-78. Suspended sediments were important in controlling metals concentrations. The degree of control was a function of the partition coefficient between adsorbed and dissolved phases of the metal, the suspended solids dynamics of the system, and the magnitude of the sediment reservoir. Metals levels in the water column can decrease due to solids adsorption and sedimentation and increase due to resuspension, usually wind-driven. Total metals concentrations in the water column were most sensitive to settling rates of suspended sediments; dissolved metals concentrations, to the value of the partition coefficient. Large percentages of cadmium (77%), lead (28-38%), and zinc (15-79% were lost to the sediments each year. Copper showed little or no loss. (Cassar-FRC)
W83-02820

VERTICAL DISTRIBUTION OF PROFUNDAL BENTHOS IN LAKE SUPERIOR SEDIMENTS,
Normandale Community Coll., Bloomington, MN.
For primary bibliographic entry see Field 2H.
W83-02822

LAKE ONTARIO SEDIMENT-MIREX RELATIONSHIPS,
State Univ. of New York Coll. at Oswego.
R. J. Scrudato, and A. DelPrete.
Journal of Great Lakes Research, Vol 8, No 4, p 695-699, 1982. 4 Fig, 1 Tab, 15 Ref.

Descriptors: *Mirex, *Pesticides, *Sediments, *Insecticides, *Lake Ontario, Oswego River, Oswego Anomaly, Bottom sediments, Lake sediments, Sedimentation rates, Organochlorine pesticides.

Mirex levels were determined in bottom sediment samples collected in the Oswego River and harbor and offshore in Lake Ontario during May 1979. Highest concentrations (1834 ng per g) were found immediately downstream from the Armstrong Cork Company discharge, 14 km upstream from the lake. Mirex concentrations were none detected to 48 ng per g in Oswego Harbor and none detected to 32.5 ng per g at the offshore dredge material disposal site 4 km offshore. In the most contaminated of 4 sites in the Oswego Anomaly offshore (depths 88-223 m) mirex levels were 22-73 ng per g in the upper 5.5 cm of sediments and below the detection limit in sediments deeper than 6.5 cm. Depth of mirex contamination at the 4 anomaly sites varied from 1.5 to 10.5 cm. There was a high correlation between organic carbon concentrations (0.6-3.7%) and mirex concentrations. Mirex-contaminated sediments are accumulating in the deep water lake sediments (> 100 m) at the rate of 2.2-7.0 mm per year. At shallower water depths sediments accumulate more slowly or are subject to redistribution. Although the river continues to supply mirex to the lake sediments, deposition is apparently decreasing, as reflected in the lower mirex levels found in the most recent sediments. However, it is estimated that covering of the contaminated sediments with clean sediment may require 200-600 years. (Cassar-FRC)
W83-02823

MORTALITY PATTERNS OF INDICATOR ORGANISMS DURING AEROBIC DIGESTION,
Black and Veatch, Denver, CO.
For primary bibliographic entry see Field 5E.
W83-02834

MICROBIOLOGICAL AEROSOLS FROM A FIELD-SOURCE WASTEWATER IRRIGATION SYSTEM,
Army Medical Bioengineering Research and Development Lab., Fort Detrick, MD.
H. T. Bausum, S. A. Schaub, R. E. Bates, H. L. McKim, and P. W. Schumacher.
Journal of the Water Pollution Control Federation, Vol 55, No 1, p 65-75, January, 1983, 4 Fig, 9 Tab, 20 Ref.

Descriptors: *Aerosols, *Wastewater irrigation, *Microorganisms, Wastewater disposal, Spray irrigation, Wastewater lagoons, Deer Creek Lake State Park, *Ohio, Lagoons, Irrigation, Bacteria, Fate of pollutants, Pathogens, Land application, Viruses, Public health, Air pollution.

The fate of bacterial aerosols generated by a sprinkler irrigation system (96 sprinklers, 2.5 ha) using ponded chlorinated domestic wastewater was determined by Andersen stacked-sieve viable-type air samplers. The wastewater characteristics were: median standard plate count, 29,000 CFU per ml; total coliforms, 170 CFU per ml; fecal coliforms, 0.55 CFU per ml; coliphages, < 2-10 PFU per ml in the second lagoon. Bacterial aerosol levels averaged 485 CFU per cu m (ranged 46-1582 CFU per cu m) above simultaneous background levels at 21-30 m downwind and were an order of magnitude less at 9.1 m above ground level and 200 m downwind. Sodium fluorescein tracer studies indicated that 0.56% of nonvolatile materials in the wastewater escaped the spray zone as an aerosol. Estimated mean bacterial dieoff was 52% at 21-30 m downwind 77% at 200 m downwind. 66-78% of particles at 21-30 m downwind were 1-5 microns in diameter, the range for efficient pulmonary deposition. Mean aerodynamic particle size of bacteria-carrying particles was 2.5-2.8 microns downwind and 4.4 microns upwind. (Cassar-FRC)
W83-02835

SOURCES OF PETROLEUM HYDROCARBON INPUTS TO THE MARINE ENVIRONMENT,
BP International Ltd., London (England).
F. G. Payne, and M. T. Westaway.
Water Science and Technology, Vol 14, No 9-11, p 1159-1170, 1982. 3 Fig, 2 Tab, 8 Ref.

Descriptors: *Water pollution sources, *Coastal waters, *Oil industry, Organic compounds, Industrial wastes, Runoff, Urban runoff, Rivers, Surface runoff, Air pollution.

The possibility of petroleum hydrocarbons entering the marine environment has increased considerably considering the following potential sources: natural seeps, offshore oil production, marine transportation and associated facilities, coastal refineries, municipal and other industrial effluents, atmosphere, and urban and river run-off. The major sources of oil contaminated effluent from refinery operations are associated with cooling water and discharges from process plant. It has been estimated that on a global basis 60,000 tonnes per annum of petroleum hydrocarbons entered the marine environment from coastal refineries. There are considerable problems in assessing the input of petroleum hydrocarbons to the marine environment from the atmosphere with 600,000 tonnes per annum representing the current estimate. A large proportion of these enter the air from vehicle

emissions. Urban and river run-off has been estimated to contribute 1.8 million tonnes per annum of the petroleum hydrocarbons entering the marine environment. About 450,000 million tonnes per annum of petroleum hydrocarbons enter the marine environment from coastal municipal and non-refinery industrial effluents. Discharges are more serious the closer to shore they occur as generally this is also the area of greater ecological sensitivity. (Baker-FRC)
W83-02863

APPLICATION TO ESTUARINE AND COASTAL WATERS,
Water Research Centre, Stevenage (England).
A. L. H. Gameson.
Water Science and Technology, Vol 14, No 9-11, p 1055-1072, 1982. 3 Fig, 66 Ref.

Descriptors: *Water pollution control, *Model studies, Planning, Mathematical models, Hydrology, Policy making, Coastal waters.

Principles which underlie the mathematical modeling of parameters of pollution in estuarine and coastal waters are outlined in non-mathematical terms. Difficulties encountered in modeling include assessing the inputs of relevant substances, evaluating coefficients of transformation processes, and ensuring that models can reasonably be used for predictive purposes. The four basic processes which a model must represent include input, transport, dispersion and transformation. The model must also take into account the hydrology of the system, and it must be validated. Two examples are given, one of which relates to dissolved oxygen in an estuary, and the other to enteric bacteria in the sea. The application of models to the formation of pollution control policies is reviewed. At present the modeling of the effect of coastal discharges does not appear to have been refined to the same extent as for estuarine discharges. The determination and representation of water movements and dispersion are more difficult, and the kinetics of bacterial mortality are not well understood. (Baker-FRC)
W83-02865

MINERALIZATION PROBLEMS IN THE PWV COMPLEX - THE IDENTIFICATION OF VIABLE SOLUTIONS BY MEANS OF A SUITE OF MATHEMATICAL MODELS,
Steward, Sviridov and Oliver, Johannesburg (South Africa).
For primary bibliographic entry see Field 5G.
W83-02881

THE ENUMERATION OF STREPTOCOCCI AND MYCOBACTERIA PRESENT IN LANDFILL LEACHATE,
Cincinnati Univ., OH. Dept. of Civil and Environmental Engineering.
J. A. Donnelly, P. V. Scarpino, and D. Brunner.
Water Science and Technology, Vol 14, No 9-11, p 1555-1556, 1982.

Descriptors: *Leachate, *Water pollution sources, *Streptococcus, Bacteria, Landfills, Waste dumps, Garbage dumps, *Mycobacteria, Fate of pollutants.

At attempt was made to measure the presence of pathogenic indicators and pathogenic microorganisms in landfill leachate to determine the significance of this leachate when it drains into the environment. The sample source was a large commercial landfill in a 600 acre site. It received 2500 tons of municipal and commercial solid waste daily. The leachate was taken at five sites 150 feet below the crest of the landfill and 50 feet above the base. Leachates from lysimeters over one year old yielded only Group D streptococci, while fresh leachate from an active commercial landfill contained streptococci from D-enterococcus, D-nonenterococcus, and the viridans groups. All of these originated in human or animal waste. The significance of these findings is the fact that relatively high concentrations of fecal streptococci, fecal pathogens and mycobacteria were present in the leachate leaving the landfill, leading potentially to a contaminated environment. (Baker-FRC)
W83-02885

THE SURVIVAL OF BACTERIAL INDICATORS IN LYSIMETERS AND LANDFILLS,
Cincinnati Univ., OH. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 5E.
W83-02886

PARASITES IN SOUTHERN SLUDGES AND DISINFECTION BY STANDARD SLUDGE TREATMENT,
Tulane Univ., New Orleans, LA. School of Public Health and Tropical Medicine.
R. S. Reimers, M. D. Little, A. J. Englande, D. B. Leftwich, and D. D. Bowman.
Water Science and Technology, Vol 14, No 9-11, p 1568, 1982.

Descriptors: *Sludge, *Parasites, *Land disposal, Waste disposal, Wastewater treatment, Municipal wastes.

This study was designed to assess the occurrence and distribution of resistant parasite stages in municipal wastewater sludges in the southern United States, to determine the fate of helminth eggs through a wastewater treatment plant, and to evaluate standard sewage sludge treatment processes for parasite inactivation effectiveness. One important finding was the poor suitability of Ascaris eggs taken from the uteri of gravid female worms as indicators of the characteristics of Ascaris eggs discharged in the feces of the host. The eggs removed from the gravid females are not as resistant to adverse factors as eggs that have undergone a hardening process in the intestines of the host and have been recovered from the feces. For the study sludge samples were collected during each of the four seasons from 27 municipal wastewater plants located in Alabama, Florida, Mississippi, Louisiana, and Texas and examined for presence and densities of resistant stages of human and animal parasites using parasitologic techniques. Viable eggs of Ascaris eggs of Ascaris and Toxocara were recovered at least once from every plant, and viable eggs of Ascaris and Toxocara were recovered at least once from every plant, and viable eggs of Trichuris vulpis and Trichuris trichiura from all but one plant. (Baker-FRC)
W83-02887

A CHEMICAL INVESTIGATION OF A MARINE SEWAGE OUTFALL,
National Research Inst. for Oceanology, Stellenbosch (South Africa).
P. D. Bartlett, and G. A. Eagle.
Water Science and Technology, Vol 14, No 9-11, p 1588-1589, 1982.

Descriptors: *Wastewater outfall, *Metals, *Water pollution effects, Table Bay, *South Africa, Zinc, Iron, Bays, Marine environment, Chemical analysis.

The behavior of sewage from a single outfall on entering the sea was studied. The contribution of this effluent to the overall chemical budget of Table Bay, situated at the northern end of the Cape Peninsula near the southwestern tip of Africa, is being investigated. Water and sediment samples were collected from 45 stations. The contour maps showed clear plumes for many of the chemical parameters extending from the outfall. The shape of the plume depends on the wind regime at the time of sampling. Degradation of the sewage leads to lower oxygen levels in the water. The highest concentrations of all the trace metals studied in the sediments were in the Granger Bay harbor entrance area. It is not yet clear if these metals originate from the sewage. All nutrients showed a net removal within the bay, which is to be expected due to the high productivity of the area. The nutrient contribution from sewage is likely to be small compared to that from the upwelling process. Most of the amounts of metals added by the effluent were insignificant compared with the masses already present. In the case of iron and zinc the amounts added daily were up to 4% of the total mass already present. Under calm conditions Zn levels could rise and give cause for concern. (Baker-FRC)
W83-02888

NUTRIENT-SALINITY RELATIONSHIPS IN FOUR ESTUARIES OF THE CAPE PROVINCE, SOUTH AFRICA,
National Research Inst. for Oceanology, Stellenbosch (South Africa).
G. A. Eagle, and P. D. Bartlett.
Water Science and Technology, Vol 14, No 9-11, p 1590-1592, 1982. 4 Ref.

Descriptors: Water pollution effects, *Estuarine environments, Dissolved oxygen, Silicates, Phosphates, Nitrates, Chemical analysis, Phytoplankton, Water analysis, Coastal waters, *Salinity, *Nutrients, *South Africa, Cape Province, *Path of pollutants.

Estuarine environments were studied to investigate possible pathways for the transport of pollutants from land to sea. The estuaries studied were the Orange, Olifants, Berg and Breede. All are relatively unpolluted except for agricultural runoff. The mouth of the Berg River has been modified by the construction of breakwaters, but other estuary mouths are still in their natural states. The degree of penetration of saltwater into the estuaries was far more dependent on river flow than on tides. The distribution and levels of dissolved nitrate in the water indicate that two nitrate sources occur - land runoff and upwelled marine water. Phosphate concentrations in estuaries normally remain more or less constant due to some form of buffering mechanism. The expected inverse linear relationship between silicate concentration and salinity was noted. However, in the Olifants River there appeared to be a rapid decrease in silicate in two stages, between salinities of 3 and 5% and 30 and 35%. The dissolved oxygen concentrations in all the rivers were close to the theoretical saturation lines. The sharp decrease noted near the freshwater-seawater interface in the Tamar estuary was not noted in any of the estuaries here. In the Olifants River there was nevertheless a drop in oxygen levels around the mid-estuary region, probably due to a high BOD in the area arising from the mortality of halophobic phytoplankton. (Baker-FRC)
W83-02889

METAL INPUT AND MOBILIZATION IN TWO ACID-STRESSED LAKE WATERSHEDS IN MAINE,
Maine Univ. at Orono. Dept. of Geological Sciences.
J. S. Kahl, and S. A. Norton.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-208256, Price codes: A05 in paper copy, A01 in microfiche. Land and Water Resources Center Completion Report, Univ. of Maine at Orono, January 1983. 70 p, 26 Fig, 9 Tab, 34 Ref, 4 Append. OWRT A-053-ME(1).

Descriptors: *Acid rain, Forest soils, *Heavymetals, Sediment-water interfaces, *Maine, Lake watersheds, Second Pond, Little Long Pond, Sediments, Lead, Zinc, Calcium, Hydrogen ion concentration.

Two ponds in Hancock County (ME), Little Long and Second, were chosen for a comparative study of metal inputs and mobilization. Seasonal pH ranges of surface waters are 4.5-5.6 at Little Long, and 6.0-6.8 at Second Pond, although precipitation loading of acids and metals is very similar. Watershed lithologies are similar; soils at Little Long are lower in exchangeable and organically-bound Ca and relatively rich in mobile Al, compared to Second Pond soils. Dated sediment chemical profiles indicate that accelerated atmospheric inputs of trace metals began in the mid-1800's. Modern sediments and soils have accumulated excess Pb and Zn, although the Zn/Pb ratio is lower in sediments and in soils than it is in precipitation, due to greater Zn mobility. Sediment depletion in Ca, Mn, and Zn in Little Long may be due to in-situ leaching of

sediments by increasingly acidic lake waters. Experiments with limnocosms show that up to 50% of the Ca and Mn, and 25% of the Zn, in recent sediments may be leached at a pH near 4.0 in less than a year. Nearly 10% of the Ca and Zn was mobilized at pH 5.0.
W83-02891

STATEWIDE EVALUATION OF TRACE ELEMENT ACCUMULATION FROM LONG TERM DISPOSAL OF WASTE WATER,
California Univ., Irvine.
For primary bibliographic entry see Field 3C.
W83-02892

HYDROCARBON SPILLS, THEIR RETENTION IN THE SUBSURFACE AND PROPAGATION INTO SHALLOW AQUIFERS,
Minnesota Univ., St. Paul. Dept. of Geology and Geophysics.
H. O. Pfannkuch.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-196477. Water Resources Research Center Completion Report, University of Minnesota, St. Paul, April 1983. 51 p, 18 Fig, 5 Tab, 4 Ref. OWRT A-041-MINN(1).

Descriptors: *Oil spill pollution, *Groundwater contamination, *Unsaturated zone propagation, Saturated zone propagation, Mass transfer, *Dissolved hydrocarbons, Laboratory retention of hydrocarbons, *Path of pollutants, Water pollution sources, Shallow aquifers.

The two most important phases in the propagation of a hydrocarbon spill into the subsurface occur in the vadose or unsaturated zone, between the land surface and the water table, and in the groundwater flow zone at its contact with the free oil phase. The last determines the dissolution and spreading of contaminants through the most mobile flow zone. The first determines the spill geometry, the amount of free phase oil that reaches the groundwater body and the total retention of spilled oil. Oil retention studies carried out for this project show whether the volume of soil within a spill site is sufficient to retain the soil without it escaping into the groundwater, and also gives a rough approximation of how long it takes for the oil phase to reach pendular saturation. Grain size and sorting distribution are integral factors governing retention, and are useful parameters in evaluating the potential damage of an oil spill and the immediate danger of groundwater contamination. Centrifuge air-oil water displacement provides a quick and first order approximate means to measure site-specific oil and water retention within the unsaturated zone of a porous media. Results show a semi-log relationship between total primary retention annd grain size (in phi units) of laboratory samples with oil-water-air systems run under 38 g in the centrifuge. A correction factor adjusts retentions to gravity drainage column pack saturations after gravity drainage used as a standard of comparison. Field samples from an oil spill site assume the same relationship when plotted against effective particle size versus total primary retention.
W83-02895

SALINITY AND BORON CONTROL UNDER HIGH-FREQUENCY LOW-VOLUME IRRIGATION,
California Univ., Davis. Dept. of Land, Air and Water Resources.
R. J. Miller, D. E. Rolston, J. W. Biggar, and R. S. Raushkolb.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-196709, Price codes: A03 in paper copy, A01 in microfiche. California Water Resources Center, Univ. of California, Davis, March 1983. 30 p, 20 Fig, (Califronia Water Resources Center Project UCAL-WRC-W-545). OWRT B-197-CAL(1).

Descriptors: *Trickle irrigation, *Salts, *Boron, *Soil profiles, *Evapotranspiration, Saline soils, Irrigation, Soil water, Grape vines, *California.

A 3-year study of the accumulation of soluble salts and boron in a soil profile following trickle irrigation with well water is completed. Irrigation treatments consisted of three levels of water applications based on estimated evapotranspiration (ET) requirements of grape vines. Estimates of ET were obtained from soil data using a neutron (CPN) meter. Soil water potentials obtained by tensiometers at different soil depths provided information about soil water movement. Analyses of soil samples taken in 1981 showed slow but continued salt and boron accumulation during irrigation periods. Plant samples showed boron accumulation in the grape leaves during the irrigation season. Leaves from the lowest irrigation level (2/3 ET) showed higher boron contents than did 3/3 ET level which was higher than the 4/3 ET irrigation treatment. Chloride accumulation in the plant leaves increased similar to that of boron, howeve, sodium did not, although it did accumulate in leaf petioles during the irrigation season in all treatments. In general, plant tissues reflected the sodium, chloride, and boron concentrations found in the soil. Grape yields in 1982 responded to the higher irrigation levels and yields were considerably larger than the local area average. (Snyder-California)
W83-02908

MICROBIAL DEGRADATION OF NATURAL AND POLLUTIONALLY-DERIVED LIGNOCELLULOSIC DETRITUS IN WETLAND ECOSYSTEMS,
Georgia Univ., Athens. Dept. of Microbiology.
R. E. Hodson, A. E. Maccubbin, and R. Benner.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-202333, Price codes: A04 in paper copy, A01 in microfiche. Environmental Resources Center Report Number ERC 03-82, Georgia Institute of Technology, Atlanta, December 1982. 58 p, 14 Fig, 5 Tab, 40 Ref. OWRT A-082-GA(1), 14-34-0001-9011.

Descriptors: *Detritus, Ecosystems, Effluents, *Lignocellulose, Pulp mill effluents, Radiolabelled lignocellulose, Wetland ecosystems, *Microbial degradation.

Wetlands have been characterized as detritus-based ecosystems. Most of the standing stock of plant biomass is not directly eaten by grazing animals, but first must be decomposed by the sediment and water microflora. In this study, the composition of a variety of wetland plants serving as sources of detritus was determined. Most of the dry weight was found to be lignocellulose. A radiotracer procedure was developed to specifically label the lignin and cellulosic moieties of lignocellulose from a variety of wetland plants. The labelled lignocelluloses were used in experiments to determine rates of detritus mineralization, solubilization, and conversion to microbial biomass under a variety of conditions characteristic of unstressed and polluted environments. Results indicate that low level pollutional stress can alter the rates and efficiencies of transformations of lignocellulosic detritus in wetland ecosystems.
W83-02913

SALINITY INVESTIGATIONS IN WEST SALT CREEK, COLORADO,
California Univ., Davis. Dept. of Land, Air and Water Resources.
L. D. Whittig, K. K. Tanji, J. W. Biggar, V. P. Evangelou, and A. E. Deyo.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-203406, Price codes: A09 in paper copy, A01 in microfiche. California Water Resources Center Completion Report, Univ. of California, Davis, March 1983. 161 p, 46 Fig, 19 TTab, 87 Ref. OWRT B-201-CAL(2).

Descriptors: *Salinity, *Saline soils, *Erosion, *Shales, Colorado River, Salts, *Dissolved salts, West Salt Creek watershed, *Colorado, *Mancos shale, Non-point pollution sources.

This investigation was aimed at assessment of the potential for contribution of dissolved mineral salts to the Colorado River by natural forces for contribution of dissolved mineral salts to the Colorado River by natural forces acting within a small, representative watershed in the Upper Colorado River Basin. The 440 km super 2 West Salt Creek watershed in west central Colorado was chosen for the study. Certain geologic strata and geomorphic landforms were identified as major contributors of dissolved mineral salts, whereas others within the watershed contribute little to the salt load of streams of the area. The Late Cretaceous marine Manocs Shale, in particular, is a principal contributor of soluble salts. In many areas, however, the saline Mancos shale is effectively protected from erosion and salt release by surface coverings of sandstone cuestas and pediment surfaces. High salt-hazard areas within the watershed are delineated and mapped. (Snyder-California)
W83-02925

CONTAMINANT TRANSPORT IN FRACTURED POROUS MEDIA: ANALYTICAL SOLUTIONS FOR A SYSTEM OF PARALLEL FRACTURES,
Waterloo Univ. (Ontario). Dept. of Earth Sciences.
E. A. Sudicky, and E. O. Frind.
Water Resources Research, Vol 18, No 4, p 1634-1642, December, 1982. 7 Fig, 12 Ref.

Descriptors: *Solute transport, *Fracture permeability, Fate of pollutants, *Porous media, Radioactive wastes, Adsorption, Advection, Diffusion.

An exact analytical solution is developed for the problem of transient contaminant transport in discrete parallel fractures situated in a porous rock matrix. The solution takes into account advective transport in the fractures, molecular diffusion and mechanical dispersion along the fracture axes, molecular diffusion from the fracture to the porous matrix, adsorption onto the face of the matrix, adsorption within the matrix, and radioactive decay. The general transient solution is in the form of a double integral that is evaluated using Gauss-Legendre quadrature. A transient solution is also presented for the simpler problem that assumes negligible longitudinal dispersion along the fracture. This assumption is usually reasonable when the advective flux in a fracture is large. A comparison between two steady state solutions, one with dispersion and one without, permits a criterion to be developed that is useful for assessing the significance of longitudinal dispersion in terms of the overall system response. Examples of the solutions demonstrate that penetration distances along fractures can be substantially larger through multiple, closely spaced fractures than through a single fracture because of the limited capability of the finite matrix to store solute. (Author's abstract)
W83-02933

RADIUM, THORIUM AND RADIOACTIVE LEAD ISOTOPES IN GROUNDWATERS: APPLICATION TO THE IN SITU DETERMINATION OF ADSORPTION-DESORPTION RATE CONSTANTS AND RETARDATION FACTORS,
Yale Univ., New Haven, CT. Dept. of Geology and Geophysics.
For primary bibliographic entry see Field 2K.
W83-02937

NUMERICAL SIMULATION OF FLOW AND CONTAMINANT MIGRATION AT AN EXTENSIVELY MONITORED LANDFILL,
Waterloo Univ. (Ontario). Dept. of Civil Engineering.
J. F. Sykes, S. B. Pahwa, R. B. Lantz, and D. S. Ward.
Water Resources Research, Vol 18, No 6, p 1687-1704, December, 1982. 17 Fig, 2 Tab, 14 Ref.

Descriptors: *Landfills, *Solute transport, *Model studies, Fate of pollutants, Leachates, Plumes, Canadian Forces Base Borden, *Ontario.

Leachate migration from the Canadian Forces Base Borden landfill, Ontario, was analyzed by a multidimensional finite-difference model for groundwater flow and contaminant transport. The site was used from 1942 to 1976 as a construction material dump and sanitary landfill. It is almost entirely above the water table. The model was validated by deriving parameters from laboratory

and field data. Small differences between measured and predicted piezometric surface were attributed to variations in potentiometric measurements, seasonal variations, and extrapolation of laboratory measurements to the field site. Variations in observed chloride-ion isopleths were typical of significant temporal plume behavior. Dispersivities were smaller than generally reported in the literature: longitudinal dispersivity, 5 m; transverse dispersivity, 0.1 m or less. Sensitivity simulations were done on the longitudinal and transverse dispersivities, imposed boundary condition potentials, hydraulic conductivity, landfill staging scheme, and sorption (potassium plume). (Cassar-FRC)
W83-02942

EDTA AS A KINETIC INHIBITOR OF COPPER(II) SULFIDE PRECIPITATION,
Maryland Univ.; College Park. Dept. of Chemistry.
G. R. Helz, and L. M. Horzempa.
Water Research, Vol 17, No 2, p 167-172, February, 1983. 4 Fig, 1 Tab, 27 Ref.

Descriptors: *Wastewater treatment, *Chelating agents, *Chemistry of precipitation, Sulfides, Trace metals, Copper, Fate of pollutants, Radioactive wastes, Laboratory studies, Natural waters, Saturation, Supersaturation, *EDTA.

EDTA (ethylenediaminetetraacetic acid) is a synethetic chelating agent widely used as a detergent additive, food stabilizer, and cleansing agent in radiochemical laboratories. This substance, which appears to be only slowly degradable in the environment, has been found in wastewater treatment plants, rivers, and groundwaters near radioactive waste disposal sites in concentrations ranging from 0.1 to 10.0 micro-molar. Laboratory tests were conducted to determine the effects of the presence to EDTA on sulfide precipitation reactions. Even in billion-fold CuS- supersaturated solutions, EDTA was found to inhibit copper sulfide precipitation for periods of at least a few hours in some cases. The rate of precipitation increased with increasing total copper and sulfide, but decreased with increasing EDTA/copper ratio. The presence of colloidal sulfur was found to accelerate the precipitation rates in acidic solutions. The results indicate that EDTA may affect the behavior of sulfophile trace metals during wastewater treatment. It is speculated that some natural chelatants may also inhibit sulfide precipitation, thus accounting for a number of reports that sulfidic natural waters are grossly supersaturated with respect to sulfide minerals. (Carroll-FRC)
W83-02956

THE MEASUREMENT OF COMPLEXATION CAPACITY AND CONDITIONAL STABILITY CONSTANTS FOR LIGANDS IN NATURAL WATERS,
Procter and Gamble Co., Cincinnati, OH.
For primary bibliographic entry see Field 5A.
W83-02957

TOXICITY ASSESSMENT OF SNOWMELT WATER RUNOFF IN AN URBAN AREA (TOXICITE DES EAUX DE RUISSELLEMENT DE LA FONTE DE NEIGE EN MILIEU URBAIN),
Institut National de la Recherche Scientifique, Sainte-Foy (Quebec).
For primary bibliographic entry see Field 5C.
W83-02958

SOME CHEMICAL CHARACTERISTICS OF MINE DRAINAGE IN ILLINOIS,
Geological Survey, Urbana, IL. Water Resources Div.
L. G. Toler.
Available from Supt. of Documents, GPO Washington, DC 20402. Price $4.50. Geological Survey Water-Supply Paper 2078, 1982. 47 p, 10 Fig, 5 Tab, 8 Ref.

Descriptors: *Acid mine drainage, *Water quality, *Water pollution, *Streams, Strip mines, Sulfates, Sampling, Sites, Chemical analysis, *Illinois.

Surface mining for coal in Illinois has affected runoff from the mined areas and altered water quality in the streams. Average annual sulfate loads in streams are 3,000 to 4,000 tons per square mile to mined land in the Big Muddy and Saline River basins in southern Illinois. Relative high concentrations of dissolved aluminum, arsenic, chromium, copper, iron, manganese, and zinc are commonly associated with concentrations of sulfate greater than about 2,000 milligrams per liter. (USGS)
W83-02971

DELINEATION AND HYDROLOGIC EFFECTS OF A GASOLINE LEAK AT STOVEPIPE WELLS HOTEL, DEATH VALLEY NATIONAL MONUMENT, CALIFORNIA,
Geological Survey, Sacramento, CA. Water Resources Div.
A. Buono, and E. M. Packard.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-127548, Price codes: A13 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 82-45, July 1982. 23 p, 6 Fig, 2 Tab, 22 Ref.

Descriptors: *Groundwater pollution, *Alluvial aquifers, *Water supply, *Water pollution effects, Gasoline, Oil-water interfaces, Leakage, Infiltration, Path of pollutants, Groundwater movement, Soil contamination, *California, Death Valley National Monument, Stovepipe Wells Hotel.

Ground water is the only local source of water available to the Stovepipe Wells Hotel facilities of the Death Valley National Monument, California. A leak in a service station storage tank caused the formation of a gasoline layer overlying the water table, creating the potential for contamination of the water supply. The maximum horizontal extent of the gasoline layer was mathematically estimated to be 1,300 feet downgradient from the leaky gasoline tank. Exploratory drilling detected the gasoline layer between 900 and 1,400 feet downgradient and between 50 and 150 feet upgradient from the source. Traces of the soluble components of gasoline were also found in the aquifer 150 feet upgradient, and 250 feet distant from the source perpendicular to the direction of ground-water movement. The gasoline spill is not likely to have an effect on the supply wells located 0.4 mile south of the leak source, which is nearly perpendicular to the direction of ground-water movement and the primary direction of gasoline movement in the area. No effect on phreatophytes 2 miles downgradient from the layer is likely, but the potential effects of gasoline vapors within the unsaturated zone on local xerophytes are not known. (USGS)
W83-02982

HYDRODYNAMIC DISPERSION DURING UNSTEADY, UNSATURATED WATER FLOW IN A CLAY SOIL,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Environmental Mechanics.
For primary bibliographic entry see Field 2G.
W83-03001

POLLUTION OF GROUND WATERS BY CHLOROCHOLINE CHLORIDE USED IN AGRICULTURE (VOPROSY ZAGRYAZNENIYA GRUNTOVYKH VOD PRI PRIMENENII KHLORKHOLINKHLORIDA V SELYSKOM KHOZYAISTVE),
Moskovskii Gosudarstvennyi Meditsinskii Inst. (I) (USSR).
S. N. Cherkinsky, V. T. Mazaev, and V. E. Vasilenko.
Gigiena i Sanitariia, No 1, p 15-18, 1980. 1 Tab, 10 Ref.

Descriptors: *Groundwater pollution, *Chlorocholine chloride, *Agricultural runoff, Field tests, *Mathematical models, Precipitation, Precipitation intensity, Agriculture, Runoff, Model studies, Soil water, *Choline chloride, Trimethylamine hydrochloride, Chemical analysis, Water quality, Water pollution sources.

Experimental and field studies indicated that chlorocholine chloride (ChChCh) can migrate from the soil to groundwater in storm and irrigation water and that the extent of this migration depends on the level of precipitation. Data are presented on the stability of ChChCh in soil and water. Mathematical models are presented describing the processes of its breakdown and migration in soil. The degradation products of ChChCh in soil are choline chloride and trimethylamine hydrochloride. The models may be used to predict the degree of groundwater pollution in places where ChChCh is used agriculturally. If its concentration in a body of water does not exceed the established permissible level, the water quality importance of trimethylamine hydrochloride is very slight. (Author's abstract)
W83-03011

ORGANIC CARBON AND OXYGEN DEMAND RELATIONSHIPS IN STORMFLOW FROM SOUTHERN PINE WATERSHEDS,
Agricultural Research Service, Oxford, MS. Sedimentation Lab.
J. D. Schreiber, and P. D. Duffy.
Soil Science Society of America Journal, Vol 46, No 1, p 142-148, January/February, 1982. 4 Fig, 6 Tab, 18 Ref.

Descriptors: *Organic carbon, *Sediment transport, *Storm runoff, Chemical oxygen demand, Oxygen demand, Storm water, Watersheds, *Forest watersheds, *Mississippi, Suspended sediments, Soil erosion, Erosion, Fate of pollutants, Organic matter, Soil organic matter, Runoff.

Stormflow from five undisturbed pine watersheds (1.5-2.8 ha) in Mississipi was analyzed for total organic carbon (TOC) and COD in solution and suspended sediment phases during the water years 1976, 1977, and 1978. Discharge weighted dissolved TOC levels were 6-16 mg per liter; dissolved COD, 20-45 mg per liter. The watersheds with soil organic matter contents in the higher portion of the 0.83-1.54% range had higher dissolved and sediment TOC and COD concentrations. Sediment TOC was 21,810-96,350 mg per kg; sediment COD, 62,600-233,340 mg per kg. TOC was enriched in the sediment compared with the soil by 3.5 to 10.1 times, depending on the specific soil. This was attributed to selective erosion of fine sediment and associated organic matter and/or deposition of coarse sediment in transport. The discharge weighted 5-day BOD in stormflow was very low, 6-11 mg 02 per liter, near the benchmark level recommended for protection of aquatic life. Of the total TOC transported (7.8-28.4 kg per ha per year) 60-77% was in the solution phase; the rest, associated with sediment. Rainfall input of TOC to the watersheds was 38-49 kg per ha per year. (Cassar-FRC)
W83-03015

HYGIENIC EVALUATION OF WATER POLLUTED BY PESTICIDES ENTERING WATER BODIES IN SURFACE RUNOFF (GIGIENICHESKAYA OTSENKA VODY, ZAGRYAZNENNOI NEKOTORYMI PESTITSIDAMI PRI POSTUPLENII IKH V VODOEM S POVERKHNOSTNYM STOKOM),
Kiev Inst. for Developmental Matters (USSR).
For primary bibliographic entry see Field 5C.
W83-03017

SALT GENERATION IN PYRITIC COAL SPOILS AND ITS EFFECT ON SATURATED HYDRAULIC CONDUCTIVITY,
Kentucky Agricultural Experiment Station, Lexington.
V. P. Evangelou, R. E. Phillips, and J. S. Shepard.
Soil Science Society of America Journal, Vol 46, No 3, p 457-460, May/June, 1982. 6 Fig, 6 Tab, 12 Ref.

Descriptors: *Hydraulic conductivity, *Coal mines, *Dissolved solids, Pyrite, Iron sulfide, Sulfides, Mine wastes, Strip mine wastes, Fate of pollutants, Oxidation, Infiltration, Laboratory studies, Soil chemistry, Solute transport, *Kentucky.

A laboratory column, 8.9 cm in diameter and 1 m long, was used to study the formation of soluble

salts by pyrite oxidation and the changes in hydraulic conductivity in a pyritic surface-mined coal spoil material from Kentucky. Upon leaching with water the hydraulic conductivity decreased from 0.50 cm per hour in the upper portion of the column to 0.03 cm per hour in the lower portion. Electrical conductivity, a measure of soluble salts, was 0.12 mmho per cm at the top of the column and 16.44 mmho per cm at the bottom. When all salts had been leached from the column, the hydraulic conductivity was nearly uniform throughout the column. (Cassar-FRC)
W83-03024

TRACE METAL COMPLEXATION BY FULVIC ACID EXTRACTED FROM SEWAGE SLUDGE: II. DEVELOPMENT OF CHEMICAL MODELS,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
G. Sposito, F. T. Bingham, S. S. Yadav, and C. A. Inouye.
Soil Science Society of America Journal, Vol 46, No 1, p 51-56, January/February, 1982. 2 Fig, 3 Tab, 30 Ref.

Descriptors: *Chelation, *Metals, *Fulvic acids, Copper, Cadmium, *Trace metals, Sludge, Model studies, Soil chemistry, Speciation, Organic acids, Mixture Model, Fulvate Model, *GEOCHEM, Fate of pollutants.

Two chemical models for trace metal complexation by fulvic acid extracted from sewage sludge were compared using the computer program GEOCHEM. The Mixture Model is a set of 9 organic acids whose acidic functional groups exist in the fulvic acid fraction of sewage sludge and whose reactions with trace metals are well known. The Fulvate Model is composed of 18 metal-fulvic acid comlexes with stability constants that have been measured in the laboratory or estimated by linear correlation analysis. The two models disagreed significantly with predictions of the extent of organic complexation of Cu(++) and Cd(++) in 21 saturation extracts obtained from 3 acid soils amended with sewage sludge. The Mixture Model predicted that Cu(++) organic complexes would be the dominant fraction; the Fulvate Model predicted that Cu(++) would be dominant. Overall speciation of Cd(++) was similar for both models and for values measured with a Cd electrode. The differences between the results predicted from the two models is related to the competitive effects in the complexation of Cu(++), Mn(++), and Fe(++) by the organic ligands in each model. In the Mixture Model most stability constants for Cu-organic complexes are considerably larger than those for Mn or Fe complexes. In the Fulvate Model stability constants are about the same. (Cassar-FRC)
W83-03030

RADON, WATER, AND AIR POLLUTION: RISKS AND CONTROL,
Maine Univ. at Orono. Dept. of Physics and Astronomy.
For primary bibliographic entry see Field 5C.
W83-03031

NUTRIENTS AND ACID IN RAIN AND DRY FALLOUT AT FAYETTEVILLE, ARKANSAS (1980-1982),
Arkansas Univ., Fayetteville. Dept. of Geology.
For primary bibliographic entry see Field 2K.
W83-03041

WATER QUALITY MODELING OF THE EQUUS BEDS AQUIFER IN SOUTH CENTRAL KANSAS,
Kansas Water Resources Research Inst., Manhattan.
M. A. Sophocleous, M. Heidari, and C. D. McElwee.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-208272, Price codes: A05 in paper copy, A01 in microfiche. Contribution No 231, December 1982. 68 p, 19 Fig, 2 Tab, 28 Ref. OWRT B-061-KAN(1), 14-34-0001-0263.

Descriptors: *Mass-transport models, Method of characteristics, *Finite element analysis, Finite difference, Groundwater flow model, Calibration, Multiple regression, Sensitivity analysis, Oil-field brines, *Groundwater quality, Equus beds aquifer, Wellington formation, Burrton oil-field, Wichita well-field, *Kansas, *Brine disposal.

The salinity problems created inthe Burrton area as a result of poor oilfield brine disposal practices of the past continue to be a major concern to the area depending on the Equus Beds aquifer for water, including the City of Wichita, Kansas. An attempt is made to predict where and how fast the brine plume will move in this area, and what the average chloride concentrations in different parts of the aquifer are. In order to made such predictions, it was necessary to get a calibrated model of the ground -water flow velocity field. Multiple regression analysis is used for parameter estimation of the steady-state groundwater flow equation applied in the most critical area of the Equus Beds aquifer. Results of such an analysis produced a correlation coefficient of 0.992 between calculated and observed values of hydraulic head. A choride transport modeling effort is then carried out despite some serious data deficiencies, the significance of which are evaluated through sensitivity analysis. Three mass-transport models employing a finite difference, a finite element and a method of characteristics approach are comparatively evaluated by applying them to the study area. It is concluded that in cases where the convection term predominates, as is the case with the study area, the method of characteristics is the better procedure to follow. Thus, starting with the quasi steady-state conditions of the early 1940's, it was possible to match the present chloride distribution satisfactorily. Chloride concentration predictions made for the year 2000 indicate that the quality of the Wichita well-field waters will not generally deteriorate from their present condition by that time.
W83-03042

TRANSPORT MODELING OF AN AGRICULTURAL PESTICIDE, PHASE I,
Kansas Water Resources Research Inst., Manhattan.
E. C. McCall, and D. D. Lane.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-208280. Contribution No 229, October 1982. 37 p, 9 Fig, 4 Tab, 40 Ref, 2 Append. OWRT A-102-KAN(1), 14-34-0001-1118.

Descriptors: *Atrazine, *Pesticides, Pesticide simulation model, Runoff, Conservation practices, Model studies, *Agricultural runoff, *Simulation analysis, Watershed management, *Path of pollutants.

A field study to examine the transport of an agricultural pesticide during a runoff event was conducted. Data indicate that significant concentrations of atrazine are contained in the runoff water. Preliminary results indicate that even a very small buffer strip between the field and the receiving waters can significantly reduce the concentration of pesticide entering the receiving waters. A simple pesticide runoff simulation model was adapted for use on a small desk top computer. The model cannot predict runoff values exactly. It can, though, be used to obtain relative values to identify watersheds which most need attention and to evaluate the effects of different conservation practices when applied to a particular watershed.
W83-03043

VARIATIONS IN GROUNDWATER QUALITY WITH DROUGHT,
Kansas Water Resources Research Inst., Manhattan.
D. O. Whittemore, G. A. Marotz, and K. M. McGregor.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-208298, Price codes: A04 in paper copy, A01 in microfiche. Contribution No 228, September 1982. 57 p, 17 Fig, 6 Tab, 22 Ref.

Descriptors: Groundwater, *Groundwater quality, *Municipal water quality, *Drought, Climate, *Climatic index, *Kansas, Saline waters, Evapotranspiration, Recharge, Infiltration, Rainfall, Water Supply, Aquifers.

Large variations in the chemical quality of municipal groundwater supplies in Kansas occur in response to dry and wet conditions. These changes are explained by varying amounts of recharge available to dilute mineralized groundwaters. The Palmer Drought Index and Eagleman Aridity Index are the best measures of climatic conditions controlling groundwater-quality variations in Kansas. Two aquifer areas of Kansas were found to contain most of the municipal well-water supplies exhibiting highly significant correlations between quality and climatic variability. In east-central Kansas, from the Nebraska to the Oklahoma state lines, groundwater is found in Permian limestones. Where these limestones contain gypsum, the hardness, sulfate, and dissolved solids concentrations increase during extended dry periods. In south-central Kansas, where groundwaters in sand and gravel aquifers may be underlain by Permian rocks containing saltwater, concentrations of sodium, chloride, and total dissolved solids increase in some well waters during drought. A couple of municipal water supplies from aquifers overlying or in Cretaceous rocks in central and north-central Kansas also show variations in either sulfate or chloride contents with dry or wet spells. Deterioration in water quality can be estimated for droughts of differing severity using linear or curvilinear relationships between water chemistry records and a climate index. These relationships can be used to predict possible variations in present and future well-water supplies in the aquifer areas generally subject to these water-quality changes.
W83-03044

METABOLIC PROPERTIES OF THIOBACILLUS FERROOXIDANS ISOLATED FROM NEUTRAL PH MINE DRAINAGE,
Alaska Univ., Fairbanks. Inst. of Water Resources.
E. J. Brown, and J. M. Forshaug.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-208306, Price codes: A04 in paper copy, A01 in microfiche. Completion Report 81-11, March 1983. 51 p, 13 Fig, 5 Tab, 82 Ref.

Descriptors: *Thiobacillus ferrooxidans, Mining, *Arsenic, *Acid mine drainage, Heavy metal leaching, *Alaska, Water pollution sources, Path of pollutants, Kinetics.

Thiobacillus ferrooxidans is found in heavy-metal contaminated drainages from placer and lode gold mines in many parts of Alaska and Canada. We have examined the iron-limited growth kinetics of a T. ferrooxidans isolate, AK1, using continuous cultures. AK1 is an arsenic tolerant isolate obtained from placer gold mine drainage containing large amounts of dissolved arsenic. The steady state growth kinetics can be described by a simple Monod equation modified for threshold ferrous iron concentrations. A supplement of 200 mg.l super -1 reduced a rsenic to the ferrous medium did not result in an increased steady state biomass nor did it appear to affect the steady state growth kinetics obtained in continuous cultures. Kinetic descriptions of the iron-limited growth of acidophilic iron-oxidizing bacteria are important for understanding the biogeochemical cycling of many metals and for application of these microorganisms to biohydrometallurgy.
W83-03045

TRANSPORT OF HEAVY METALS ON SUSPENDED SEDIMENTS UNDER HIGH FLOW CONDITIONS IN A MINERALIZED REGION OF WALES,
University Coll. of Wales, Aberystwyth. Dept. of Geography.
S. B. Bradley, and J. Lewin.
Environmental Pollution, Series B, Vol 4, No 4, p 257-267, 1982. 5 Fig, 2 Tab, 22 Ref.

Descriptors: *Metals, *Sediment transport, *Floods, Fate of pollutants, *Mine wastes, Heavy metals, Lead, Zinc, Cadmium, Iron, Sulfur, Phosphorus, Suspended sediments, Ystwyth River,

*Wales, Chemical precipitation, Adsorption, High flow.

Concentrations of Pb, Zn, Cd, Fe, S, and P on the surface of suspended sediments in the River Ystwyth, Wales, were determined over a 40 hour flood period June 1 to 3, 1981. Pb and Zn are supplied to the river by abandoned mines. During this flood the discharge peaked at 16 cumecs, 6 hours after the peak suspended sediment concentration of 70 mg per liter. Generally, the metals concentrations on the sediment surface decreased as discharge increased, due to dilution with clean sediment. On the falling limb of the hydrograph, sorption and coprecipitation by Fe/Mn complexes acted as a sink for the metals. The correlation of Pb and Zn levels with P and S levels suggests the formation of Pb and Zn phosphates and sulfides on the sediment surface. Total Pb and Cd on the sediment surface being transported was greatest during higher discharges, but total Zn transport was lower during high discharge, reaching a peak immediately after the discharge peak. (Cassar-FRC)
W83-03048

COMPUTATION OF THE INDEX OF POLLUTION CAUSED BY HEAVY METALS IN RIVER SEDIMENT,
Nippon Inst. of Tech., Saitama. Applied Statistics Lab.
H. Nishida, M. Miyai, F. Tada, and S. Suzuki.
Environmental Pollution, Series B, Vol 4, No 4, p 241-248, 1982. 2 Fig, 2 Tab, 9 Ref.

Descriptors: Metals, *Sediments, *Pollution index, Fate of pollutants, *Heavy metals, Rivers, *Japan, Estuaries, Copper, Zinc, Lead, Cadmium, Path of pollutants.

Heavy metals levels were measured in sediments from 92 Japanese rivers to develop an index of pollution (t) based on the idea that the upper 10% of the distribution of t for a standard group of rivers is considered polluted. Hydrochloric acid-soluble Cu, Zn, Pb, and Cd data from upstream sediments produced a critical point pollution value of 2.57 for the four heavy metals. Metals levels in the estuary sediments of the same rivers showed that 35 rivers had pollution indexes greater than 2.57. These polluted rivers included the Tama, Tsurumi, Syonai, and other urban rivers as well as rivers such as the Jintsu and Kitakami, passing through mining areas. In general the rivers of the Tohoku and Kanto districts, along the shore of the Seto Inland Sea, and along the Hokuriku coast had t values higher than 2.57. Most rivers in the Hokkaido and Sanin districts were considered unpolluted. (Cassar-FRC)
W83-03049

DETERMINATION OF NUTRIENT AND METAL RELEASE RATES IN SEDIMENTS FROM ENVIRONMENTALLY POLLUTED IMPOUNDMENTS OF RUNNING WATERS WITH THE AID OF INCUBATION EXPERIMENTS. PART 2: INVESTIGATIONS ON NITROGEN AND MANGANESE RELEASE (BESTIMMUNG VON NAHRSTOFF- UND METALLFREISETZUNGSRATEN AUS SEDIMENTEN UNWELTBELASTETER FLIESSGEWASSERSTAU-HALTUNGEN MIT HILFE VON INKUBATIONSVERSUCHEN. TEIL 2: UNTERSUCHUNGEN ZUR STICKSTOFF-UND MANGANFREISETZUNG),
Technische Univ., Dresden (German D.R.). Bereich Hydrobiologie.
J. Helbig, H. Reissig, and R. Holzig.
Acta Hydrochimica et Hydrobiologica, Vol 9, No 3, p 331-336, March, 1981. 2 Fig, 1 Tab, 8 Ref. (No English Summary).

Descriptors: *Reservoirs, *Fluvial sediments, *Nitrogen, *Manganese, *Free surfaces, Aerobic conditions, Anaerobic conditions, Ammonium, Nitrates, Denitrification, Hydrogen ion concentration, Incubation, Sediments, Oxidation, Water pollution, Nitrogen compounds, *German Democratic Republic, Kriebstein reservoir, Zwickauer Mulde river, Rochlitz storage reservoir.

Nitrogen and manganese release in sediments from the Kriebstein reservoir and the Rochlitz storage basin on the Zwickauer Mulde river (German Democratic Republic) was studied in long-term incubation experiments. During the initial phase of incubation of Kriebstein reservoir sediments (< 50 days), and intense ammonium release took place, caused by the escape of interstitial water in the course of sediment thickening. A simultaneous decrease in ammonium and increase in nitrate concentrations in the aerobic free water zone after day 6 indicated that nitrification began in the water at this time. Nitrate concentration decreased again on day 12 due to diffusion of nitrate into the sediment and associated denitrification. The mean nitrogen release rate was 10 mmol/sq m/day for the Kriebstein reservoir and 50-60 mmol/sq m/day for Zwickauer Mulde sediments. At Kriebstein, the decrease in nitrogen release rate with incubation time was markedly less under anaerobic than under aerobic conditions. In Zwickauer Mulde sediments, nitrogen release rates up to day 110 of incubation were 3.8 times higher than Kriebstein rates under aerobic conditions and 4.8 times higher under anaerobic conditions (for 10-cm sediment thicknesses). This was due to higher nitrogen contents in the original sediments from the Zwickauer Mulde (3.5 times higher for total nitrogen, 5.2 times higher for ammonium in the watery phase). For Kriebstein sediments, manganese release rates could be analyzed up to day 120 of incubation, the mean rate being 0.09 mmol/sq m/day. At Rochlitz, manganese release rates lay between 0.05 and 0.19 mmol/sq m/day under anaerobic conditions forthe 64-day incubation period and were dependent on sediment thickness (2, 10, or 25 cm). Under aerobic conditions, the mean rate was 0.05-0.32 mmol/sq m/day. This higher rate could be due to lower pH values in the oxidized upper layer (caused by nitrification). (Gish-FRC)
W83-03052

DETERMINATION OF NUTRIENT AND METAL RELEASE RATES IN SEDIMENTS FROM ENVIRONMENTALLY POLLUTED IMPOUNDMENTS OF RUNNING WATER WITH THE AID OF INCUBATION EXPERIMENTS. PART 1: DETERMINATION OF RATES OF PHOSPHORUS AND IRON RELEASE (BESTIMMUNG VON NAHRSTOFF- UND METALL-FREISETZUNGSRATEN AUS SEDIMENTEN UMWELTBELASTETER FLIESSGEWASSERSTAUHALTUNGEN MIT HILFE VON INKUBATIONSVERSUCHEN. TEIL 1: BESTIMMUNG VON PHOSPHOR- UND EISENFREISETZUNGSRATEN),
Technische Univ., Dresden (German D.R.). Bereich Hydrobiologie.
J. Helbig, H. Reissig, and R. Holzig.
Acta Hydrochimica et Hydrobiologica, Vol 9, No 2, p 203-212, February, 1982. 2 Fig, 6 Tab, 7 Ref. (No English Summary).

Descriptors: *Reservoirs, *Fluvial sediments, *Phosphorus, *Iron, *Anaerobic conditions, Aerobic conditions, Incubation, Sediments, Sediment-water interfaces, Oxidation, Dissolved oxygen, Water pollution, Organic matter, Limiting factors, *German Democratic Republic, Kriebstein reservoir, Zwickauer Mulde river, Rochlitz storage reservoir, *Path of pollutants.

Phosphorus (P) and iron (Fe) release from sediments in water from the Kriebstein reservoir and the Rochlitz storage basin on the Zwickauer Mulde river (German Democratic Republic) was studied in long-term incubation experiments. In the first stages of incubation (< 50 days), curves showing the cumulative release of P and Fe in relation to incubation time were similar for both aerobic and anaerobic incubation conditions. After this point, they began to diverge widely, with the curve for anaerobic conditions rising much more sharply. The reduction in release rate for aerobic incubation was due to an increase in thickness of the oxidized upper sediment layer: the thicker this layer, the longer was the time required for the transport through this zone of reducing substances from the deeper layers. P and Fe release rates for the Kriebstein reservoir could be divided into three categories: for the highly oxidized upper sediment layer, release rates for P and Fe, respectively, were 0.02-0.05 and 0.1 mmol/sq m/day; for the transition from aerobic to anaerobic conditions, rates were up to 5 and up to 25 mmol/sq m/day for P and Fe, respectively; for the permanently anaerobic upper sediment layer, rates were 0.1-0.3 and 0.5-1.5 mmol/sq m/day for P and Fe. The Zwickauer Mulde sediments contained higher levels of organic matter and presented more strongly limiting conditions, which impeded the formation of a permanently oxidized upper sediment layer. Release rates for these sediments could be divided into only two categories: for aerobic conditions in the sediment-water interface zone, release rates were 1-2 mmol/sq m/day for both P and Fe; while for anaerobic conditions in the sediment-water interface zone, they were 2-3 mmol/sq m/day for both P and Fe. (Gish-FRC)
W83-03053

THE INFLUENCE OF ADSORPTION ON GLASS, PH AND TEMPERATURE ON THE DISAPPEARANCE OF PERMETHRIN IN AQUEOUS SYSTEMS,
Guelph Univ. (Ontario). Dept. of Environmental Biology.
M. S. Sharom, and K. R. Solomon.
Environmental Pollution, Series B, Vol 4, No 4, p 269-279, 1982. 6 Fig, 1 Tab, 10 Ref.

Descriptors: *Insecticides, *Degradation, *Adsorption, Fate of pollutants, *Permethrin, *Pesticides, Temperature effects, Hydrogen ion concentration, Glass.

Factors affecting the adsorption and degradation of permethrin in water samples stored in glass containers were investigated. The fate of C14 labeled permethrin at a concentraton of 10 micrograms per liter in lake water was followed for 4 weeks under several treatments. Agitation of the sample bottles prior to residue analysis showed that loss of permethrin in azide-treated water (75% remaining after 4 weeks) and in untreated water (10% remaining after 4 weeks) was a result of degradation, with dichlorovinyldimethylcyclopropanedicarboxylic acid as the main metabolite. Degradation was much slower in azide-treated water, indicating that microorganisms have an important role in permethrin degradation. When bottles were not shaken prior to sampling, radioactivity in untreated water decreased to 71% at 1 week and rose to 95% at 4 weeks, showing adsorption of permethrin onto the glass surface (maximum at 1 week) and subsequent degradation. Radioactivity in the unshaken azide-treated samples was 65, 62, 48, and 47% at 0.5, 1, 2, and 4 weeks, respectively, the result of increased adsorption onto the glass walls and slower degradation. Degradation of permethrin at 4 and 15C was not greatly influenced by pH; 70% remained after 4 weeks. However, at 30C the insecticide degraded more rapidly at pH 4 and 9 than at pH 7. (Cassar-FRC)
W83-03057

WATER QUALITY IMPROVEMENT IN THE FIRTH OR FORTH: A DISCRIMINANT FUNCTIONAL ANALYSIS,
Napier Coll. of Commerce and Technology, Edinburgh (Scotland).
For primary bibliographic entry see Field 5G.
W83-03059

SORPTION AND SEDIMENTATION OF ZN AND CD BY SESTON IN SOUTHERN LAKE MICHIGAN,
Argonne National Lab., IL.
J. I. Parker, K. A. Stanlaw, J. S. Marshall, and C. W. Kennedy.
Journal of Great Lakes Research, Vol 8, No 3, p 520-531, 1982. 10 Fig, 2 Tab, 30 Ref.

Descriptors: *Lakes, Metals, *Plankton, *Zinc, *Cadmium, *Sorption, Seston, Sedimentation, Seasonal variations, Lake sediments.

The sorption and sedimentation of zinc and cadmium by southern Lake Michigan seston particles were investigated using Zn-65 and Cd-109 in 21 radiotracer experiments. The time-series sorption

by total seston greater than 0.45 micrometers was asymptotic, with apparent equilibria of about 100-200 ng Zn/L and about 1.0 to 2.0 ng Cd/L, occurring in 24-30 hr during the summer phytoplankton bloom. Studies of the sorption by different particle size fractions showed that the abundance of phytoplankton and detritus control the concentrations of particle-bound Zn and Cd. The seasonal maximum concentrations of particle-bound Zn and Cd correlated well with the development of both the summer and fall phytoplankton blooms. Serial additions of Zn and Cd in combination with the radiotracers showed that these additions inhibit the sorption of both metals as their toxic effects are expressed. Coupling of the particle-bound Zn and Cd estimates for the period May to December with data on the seasonal variations in the net settling velocity in southern Lake Michigan provided annual sedimentation rates of about 9 micrograms Zn/sq cm/yr and about 0.1 micrograms Cd/sq cm/yr that are in excellent agreement with similar estimates by other investigators. The experiments suggest that, if the dissolved concentrations of Zn and Cd do increase to toxic levels, the impacts on phytoplankton may potentiate further increases in the dissolved levels by reducing plankton sorption and removal by sedimentation. (Baker-FRC)
W83-03083

IDENTIFICATION OF TOTAL AND BIOLOGICALLY SENSITIVE FORMS OF TOXIC METAL INPUTS TO AN URBAN AFFECTED RIVER,
Washington Univ., Seattle. Fisheries Research Inst.
For primary bibliographic entry see Field 5A.
W83-03105

SEASONAL PATTERNS AND MOLECULAR WEIGHT VARIATIONS OF TRIHALOMETHANE PRECURSORS AND TRIHALOMETHANE FORMING POTENTIAL IN THE KAW RESERVOIR,
Oklahoma State Univ., Stillwater. School of Civil Engineering.
J. N. Veenstra.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-208884, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Research Institute Completion Report, Oklahoma State Univ., Stillwater, March 1983. 53 p, 21 Fig, 5 Tab, 57 Ref. OWRT A-101-OKLA(1), 14-34-0001-1138.

Descriptors: *Ozonation, *Trihalomethanes, *Apparent molecular weight, *Seasonal variations, Ozone, Halogens, Reservoirs, Organic carbon, Humic acids, Pretreatment of water, Kaw Reservoir, *Oklahoma, Arkansas River.

The research involved looking at the seasonal variations over eleven months in the trihalomethane concentrations and the trihalomethane forming potential of water taken from the Kaw Reservoir, located on the Arkansas River in northern Oklahoma. The work also investigated seasonal variations in the quantity and apparent molecular weight of the organic precursors of trihalomethanes. Ozonation of Kaw Reservoir water was also looked at to determine its effect of the trihalomethane forming potential and the apparent molecular weight distribution of the naturally occurring organic compounds. During the study, ozonation caused a greater reduction in THMs than in TOC. The mean TOC reduction percentage was 9.4 + or - 22.9 while the mean percentage reduction in THM forming potential was 15.3 + or - 13.9. The results show that the ability of ozone to reduce the THM forming potential was sporadic, and its effect on the individual THMs varied with bromoform showing the smallest mean percentage reduction. The data showed a statistically significant difference between the THMs produced in the ozonated and unozonated samples. There was no correlation found between ozone dose and TOC, THM or U.V. absorbance reduction. The naturally occurring organic showed a predominance in the molecular weight range of 1000-5000. Seasonal shifts in the molecular weights of these organics were seen along with the ability of ozone to affect the shift.
W83-03108

FACTORS CONTROLLING BLUE-GREEN ALGAE DOMINANCE IN A SOUTHWESTERN RESERVOIR,
Oklahoma State Univ., Stillwater. Dept. of Zoology.
For primary bibliographic entry see Field 5C.
W83-03109

POTENTIAL ORGANOMETALLIC CARCINOGENS IN WASTEWATER EFFLUENTS FROM COAL GASIFICATION PLANTS,
North Dakota State Univ., Fargo. Dept. of Chemistry.
P. Boudjouk, and J. B. Woell.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-208900, Price codes, A06 in paper copy, A01 in microfiche. North Dakota Water Resources Research Institute Completion Report, North Dakota State University, Fargo, January 1983. 112 p, 3 Fig, 9 Tab, 88 Ref, 2 Append. OWRT B-059-NDAK(1).

Descriptors: Chemical reactions, Synthesis, *Organometallic complexes, Organic matter, *Organic compounds, Phenalene, Betones, Thiones, Coal gasification, Industrial wastewater, Carcinogens.

The syntheses of the first transition metal complexes of phenalene are described. The reaction of Fe sub 2(CO) sub 9 with phenalene gave n super 2-(phenalene) tetracarbonyliron (0) while n super 2-(phenalene)dicarbonylcyclopentadienyliron(I) tetrafluoroborate was prepared from phenalene oxide, Fe(CO) sub 2 Cp- and HBF sub 4. The photolysis of a hexane solution of phenalene and (Ch sub 3 C sub 5 H sub 4)Mn(CO) sub 3 gave n super 2-(phenalene)dicarbonyl(methylcyclopentadienyl) manganese(O). A new synthesis of cycloprop(a)acenaphthylene, the valence isomer of phenalene, was developed. Fe(CO) sub 2 Cp(isobutylene) super + BF sub 4- was found to catalytically isomerize cycloprop(a)acenaphthylene to phenalene, representing one of only a few examples of catalytic activity by the Fe(CO) sub 2 Cp super + moiety. The mechanism of this reaction was explored and isotopic studies suggested that an intermediate in this isomerization was fluxional with the iron hopping from ring to ring. Dicarbonylcyclopentadienyliron(I) complexes of very basic ketones and thiones were prepared. The x-ray structure of the tropone and diphenylcyclopropenethione showed these complexes to be O and S bound, respectively. These structures also showed that the positive charge of the Fe(CO) sub 2 Cp super + moiety was not delocalized on to the ketone and thione ligands. The preparation of one of these complexes, (diphenylcyclopropenone)dicarbonylcyclopentadienyliron(I) tetrafluoroborate, was the first example of a complex of this ketone without ring opening. The reaction of Fe(CO) sub 2 Cp(isobutylene) super + BF sub 4 super - with thiobenzophenone gave only the S bound complex and no ortho-metalation was observed.
W83-03110

THE EFFECTS OF PH AND REDOX POTENTIAL ON THE RELEASE OF HEAVY METALS FROM ARKANSAS RIVER SEDIMENTS,
Oklahoma State Univ., Stillwater. School of Civil Engineering.
M. H. Bates.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-209023, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Institute Completion Report, Oklahoma State Univ., Stillwater, March 1983. 41 p, 9 Fig, 1 Tab, 69 Ref.

Descriptors: Copper, Cadmium, Chromium, Lead, Zinc, *Oxidation-reduction potential, *Sediments, Rivers, Atomic absorption spectrophotometry, *Heavy metals, *Hydrogen ion concentration, *Arkansas River, *Oklahoma, Tulsa, Sediment analysis, Path of pollutants.

The release of copper, cadmium, chromium, lead and zinc from sediments obtained from the Arkansas River in Tulsa, Oklahoma was examined in laboratory systems at various pH and oxidation-reduction potential values. Maximum release of the metals as a function of pH occurred either in the very acidic or the very alkaline pH range, and it is therefore, unlikely that a significant release of the metals would be observed in situ for an extended period of time. Anaerobic conditions promoted the release of copper, and lead, and zinc although aerobic release was also observed. The release of cadmium was not significantly affected by varying the redox potential, and the release of chromium was found to increase with an increase in the oxidation-reduction potential.
W83-03112

TOXIC SUBSTANCE MODELS FOR THE UPPER MISSISSIPPI AND MISSOURI RIVERS,
Iowa Univ., Iowa City. Inst. of Hydraulic Research.
A. R. Giaquinta.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-209049, Price codes: A04 in paper copy, A01 in microfiche. IIHR Report No 95, August 1982. 58 p, 19 Fig, 2 Tab, 8 Ref, 2 Append. OWRT B-069-IA(1), 14-34-0001-9149.

Descriptors: *Mathematical model, Toxic chemicals, Water quality, *Convection, *Diffusion, Rivers, Model studies, *Path of pollutants, *Missouri River, Upper Mississippi River, *Finite difference methods.

A time variable model for the solution of the two-dimensional convection-diffusion equation in curvilinear coordinates was developed. The model was a finite difference scheme to solve the convection-diffusion equation using the alternating direction implicit (ADI) method. The model applies to the discharge of conservative substances and to simple first-order, decaying toxic chemicals. A dye study, conducted by the U.S. Army Corps of Engineers on a 27 mile reach of the Missouri River, was used for verification of the model. The model results were in good agreement with the field data.
W83-03114

SOURCES, SINKS, AND STORAGE OF RIVER SEDIMENT IN THE ATLANTIC DRAINAGE OF THE UNITED STATES,
Geological Survey, Denver, CO.
For primary bibliographic entry see Field 2J.
W83-03117

TURBIDITY IN THE WESTERN BASIN OF LAKE ERIE,
Environmental Protection Agency, Narragansett, RI.
For primary bibliographic entry see Field 2J.
W83-03118

THE IMPACT OF ENERGY DEVELOPMENT IN THE TONGUE RIVER BASIN, SOUTHEASTERN MONTANA,
Ohio Wesleyan Univ., Delaware. Dept. of Geography and Geology.
For primary bibliographic entry see Field 4C.
W83-03139

AN EXAMINATION OF LAND USE - NUTRIENT EXPORT RELATIONSHIPS,
Kentucky Natural Resources and Environmental Protection Cabinet, Frankfurt. Div. of Water.
M. N. Beaulac, and K. H. Reckhow.
Water Resources Bulletin, Vol 18, No 6, p 1013-1024, December, 1982. 6 Fig, 2 Tab, 75 Ref.

Descriptors: *Land use, *Nutrients, *Nonpoint pollution sources, Fate of pollutants, Water pollution sources, Forest watersheds, Agricultural watersheds, Urban watersheds, Nitrogen, Phosphorus, Runoff, Climates, Fertilizers, Soil types, Farm wastes, Farm management, Pastures, Feedlots, Manure, Reviews, Watershed management.

A literature review of nutrient export studies relates land use to fluxes of phosphorus and nitrogen.

The magnitude of nutrient flux is influenced by land use (considered here are forest, agricultural, and urban watersheds) in general and by soils, climate, and land cover management practices in particular. Nutrient export from forest land is low and homeostatic; from urban watersheds, high and widely variable. In forest land higher nutrient loads result from hardwood watersheds than from softwood watersheds, from loams and sedimentary formations rather than sand overlying granites, and from glaciated regions. Nutrient flux is greater in warm humid climates than in drier climates. In agricultural lands the factors promoting high nutrient loads are fallow land, clay or organic soils, application of fertilizers before or during high runoff periods, over- or under- fertilization, row cropping, poor infiltration, high farm animal density, lack of detection basins, and a greater proportion of nitrogen-fixing crops. Sources of nutrients in urban areas are impervious surfaces, atmospheric emissions, deicing chemicals, street dirt, construction site erosion, industrial spills, and illegal wastewater discharges. As watersheds become increasingly removed from the natural state and the degree of human pertubation increases, the ability to predict the interactions between land use and response of water bodies becomes less precise and more difficult. (Cassar-FRC)
W83-03144

A MODELING APPROACH FOR STORM WATER QUANTITY AND QUALITY CONTROL VIA DETENTION BASINS,
Princeton Univ., NJ. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5G.
W83-03147

5C. Effects Of Pollution

THE INFLUENCE OF SEX, SIZE, AND SEASON ON MIREX LEVELS WITHIN SELECTEL TISSUES OF LAKE ONTARIO SALMON,
O.H. Materials Co., Findlay, OH.
S. E. Insalaco, J. C. Makarewicz, and J. N. McNamara.
Journal of Great Lakes Research, Vol 8, No 4, p 660-665, 1982. 2 Fig, 2 Tab, 34 Ref.

Descriptors: *Mirex, *Pesticides residues, *Fish, Fate of pollutants, *Salmon, *Lake Ontario, Insecticides, Sport fishing, Seasonal variation, Organochlorine pesticides.

Mirex concentrations were determined in tissues of coho (Oncorhynchus kisutch) and chinook (O. tschwaytscha) salmon collected from Lake Ontario during spring and autumn of 1977 and 1978. The range of mirex levels was 0.05 to 0.42 mg per kg, with no significant difference between coho and chinook salmon. Mean mirex levels (mg per kg) in the tissues of 24 fish sampled were: fillet, 0.22; belly flap, 0.22; skin, 0.21; red muscle, 0.17; dorsal loin, 0.12; and caudal peduncle, 0.12. Statistically, the tissues were grouped according to similar mirex levels as follows: fillet/belly flap/skin; red muscle; and dorsal loin/caudal peduncle. In general, mirex concentrations increased with individual fish weight and appeared to parallel the lipid concentrations of tissues. Mirex concentrations were statistically different between sexes and seasons in some tissues, but no pattern was evident. By selectively removing the red muscle, belly flap, and skin from the fish fillet before consumption, the mirex levels in the edible portion can be reduced by 56%. (Cassar-FRC)
W83-02841

ORGANOCHLORINE AND HEAVY METAL RESIDUES IN STANDARD FILLETS OF COHO AND CHINOOK SALMON OF THE GREAT LAKES - 1980,
Michigan Dept. of Natural Resources, Lansing. Office of Toxic Materials Control.
T. K. Rohrer, J. C. Forney, and J. H. Hartig.
Journal of Great Lakes Research, Vol 8, No 4, p 623-634, 1982. 5 Fig, 3 Tab, 40 Ref.

Descriptors: Fish, Metals, *Pesticide residues, Fate of pollutants, *Heavy metals, *Organochlorine pesticides, *Salmon, Great Lakes, Lake Michigan, Polychlorinated biphenyls, DDT, Dieldrin, Mercury, Bioaccumulation, Accumulation, Zinc.

Coho and chinook salmon collected in the fall of 1980 from 7 Michigan tributaries to the Great Lakes contained (in standard skin-on fillets) polychlorinated biphenyls (PCB), DDT, dieldrin, zinc, and mercury, but no detectable aldrin, chlordane, heptachlor, heptachlor epoxide, toxaphene, arsenic, cadmium, chromium, copper, or lead. Total DDT levels were 0.06-2.27 mg per kg in coho salmon and 0.29-3.40 mg per kg in chinook salmon; no fish specimens were above the FDA action level of 5 mg per kg total DDT for fillets. These values were 75% less than DDT levels in similar fish examined in 1971. PCB (Aroclor 1254 predominating) concentrations were 0.66-6.10 mg per kg in coho and 2.0-16.0 mg per kg in chinook. Six of the 63 coho and 29 of the 50 chinook had total PCB levels exceeding the FDA action level of 5 mg per kg. The maximum dieldrin residue was 0.17 mg per kg (FDA action level, 0.3 mg per kg). Mercury residues were none detected to 0.35 mg per kg in coho and 0.15-0.55 mg per kg in chinook (FDA action level, 1 mg per kg). In general, chinook salmon had higher contaminant levels than coho salmon collected at the same time and place. Most highly contaminated fish were found in the St. Josephs River tributary (most southern station); least contaminated fish were from Lake Erie tributaries (Huron River). PCB and DDE residues were strongly correlated. Skinless fillets had about half the DDT levels and about 1/4 the PCB levels of skin-on fillets. (Cassar-FRC)
W83-02843

THE IMPACT OF DIFFUSE ATMOSPHERIC NUTRIENT LOADING ON AN OLIGOTROPHIC FRESHWATER LAKE IN A DEVELOPING URBAN AND INDUSTRIAL AREA (RICHARDS BAY, SOUTH AFRICA),
National Inst. for Water Research, Congella (South Africa). Natal Regional Lab.
C. G. M. Archibald, and M. S. Muller.
Water Science and Technology, Vol 14, No 9-11, p 1533-1534, 1982.

Descriptors: Water quality, *Water pollution effects, *Oligotrophic lakes, Lakes, Industrial wastes, *South Africa, Richards Bay, Nutrients, Algal blooms, Lake Mzingazi.

Lake Mzingazi is a large natural freshwater lake in the Richards Bay area, currently the only existing supply of water for the area or a new harbor. The small seaside resort of Richards Bay has expanded rapidly since 1970. Industrial developments have included a coal terminal construction, an aluminum smelter and a phosphoric acid factory. An algal bloom dominated by Anabaenopsis raciborskii developed in the lake during spring and summer of 1978, following the initial industrial period. Chlorophyll a levels in the lake rose sharply, from 11 to 33 micrograms/liter. A study of the lake indicated that atmospheric nutrient inputs constituted about 67.3% of the annual phosphorus load and 69.1% of the annual nitrogen load. Changes in the pattern of the atmospheric nutrient input may therefore be expected to have a great impact on the lake. (Baker-FRC)
W83-02850

THE STRIPED BASS DECLINE IN THE SAN FRANCISCO BAY-DELTA ESTUARY,
J. F. Arthur, L. W. Botsford, T. Cannon, G. C. Cox, and S. R. Hansen.
Report to the California State Water Resources Control Board, Sacramento, November 1982. 58 p, 27 Fig, 2 Tab, 32 Ref, 1 Append.

Descriptors: *Bass, *Photoplankton, *Fish eggs, *Fish diets, *Fish toxins, Heavy metals, Zinc, Petroleum hydrocarbons, Zooplankton, Fish farming, *California, San Francisco Bay-Delta estuary.

The adult population of striped bass is only one-quarter of what it was twenty years ago, and the production of young over the past five years is one-third to one-half of the expected values. The cause is most likely one or more of the following factors: reduced plankton food supply for the young in the western Delta and Suisun Bay, probably as a result of export pumping of water by the CVP/SWP; entrainment in diversions; inadequate egg production; and high levels of toxic substances. Petroleum hydrocarbons and zinc are strongly implicated as having adverse effects on the reproductive capacity and fitness of adult spawning striped bass. The bass eggs also contain significantly higher amounts of pesticides and PCBs than those from Coos River, Oregon; levels equal and exceed those reportedly causing poor survival of the early life stages of the other species. More intensive toxicant monitoring is recommended. To mitigate the reduced egg production, it is suggested that catching female bass be reduced. Hatchery production may also be useful. The study group agreed that entrainment losses in diversions are unlikely to be the cause of the recent bass decline but that they do contribute to the losses. The mose probable cause for the decline is inadequate food supply; phytoplankton necessary for the development of zooplankton has been extremely low. The reduced and delayed production may be related to the use of Delta channels to convey water to the CVP/SWP export pumps in the South Delta. An export reduction to 2500 cfs in late spring is recommended. (Atkins-Omniplan)
W83-02919

WASTE FROM THE WATER TREATMENT PLANT AT ALTON AND ITS IMPACT ON THE MISSISSIPPI RIVER,
Illinois State Water Survey Div., Champaign.
For primary bibliographic entry see Field 5E.
W83-02920

METABOLISM OF CALIFORNIA STREAM FISHES,
California Univ., Davis. Dept. of Wildlife and Fisheries Biology.
J. J. Cech.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-206284, Price codes: A03 in paper copy, A01 in microfiche. California Water Resources Center, Completion Report, Univ. of California, Davis, April 1983, 27 p, 8 Tab, 17 Ref. OWRT A-082-CAL(1).

Descriptors: *Fish, Trout, Sucker, Sculpin, Perch, Roach, *Oxygen requirements, *Metabolism, *California.

Respiratory metabolic (oxygen consumption) rates were measured for rainbow trout, Sacramento squawfish, Sacramento sucker, hardhead, tule perch, riffle sculpin, and California roach at acclimated temperatures of 10, 20, 30C and two levels of dissolved oxygen: Normoxia (air-saturated) and hypoxia (about 25% of the oxygen concentration at full air saturation). After an overnight 5C temperature elevation, oxygen consumption rates were measured again at the same two dissolved oxygen levels, to better understand the effects of short- and long-term environmental changes resulting from altered stream flows. In general, all seven species increased their respiratory metabolic (= food and oxygen) requirements with acclimation and short-term temperature elevations. Additional data from Sacramento squawfish acclimated to 15 and 25C revealed that short-term temperature elevations increase metabolism to higher rates than does long-term acclimation at the same temperatures. Comparative, mass-independent metabolic rates at 20C showed rainbow trout > Sacramento squawfish > Sacramento suckers, hardhead and tule perch > Calif. roach and riffle sculpin. Stream flow reductions, causing warmed and/or hypoxic conditions would produce predictable effects on California stream fish communities from the collected metabolic and mortality data. In general, the most sought-after sportfishing species (rainbow trout) would be the first species with physiological and survival problems, and California roach would be the last. (Snyder-California)
W83-02944

PHYSICAL AND CHEMICAL PROPERTIES OF POND WATERS RECEIVING WARM-WATER EFFLUENT FROM A THERMAL POWER PLANT,

Jyvaeskylae Univ. (Finland). Dept. of Biology.
P. V. Eloranta.
Water Research, Vol 17, No 2, p 133-140, Febuary, 1983. 11 Fig, 2 Tab, 14 Ref.

Descriptors: *Cooling water, *Thermal pollution, *Stratification, Water pollution effects, Ponds, Ice cover, Water temperature, Thermal powerplants, Temperature, Powerplants, Thermal stratification, Vasikkalampi Pond, *Finland, Oxygen depletion, Water quality, Phytoplankton.

Cooling water discharged from a 35 MW thermal powerplant into Vasikkalampi Pond, Finland, 30,700 sq m in area and 115,000 cu m in volume, affected the physical and chemical properties of the pond water. The powerplant, which supplies heat for urban homes,operates only during September through May. Cooling water is removed from the middle of the pond and returns to the northern end as a spray. The major changes caused by the heated effluent were: (1) a shortened ice cover period (only short periods during December through March) and (2) increase of the normal 3-month chemical and thermal stratification period to 6-7 months (April-October). The stratification depleted oxygen in the hypolimnion. Secchi disc transparencies varied from 0.4 to 3.5 mm and were highest in winter and lowest in June. Levels of silica, phosphates, and total phosphorus, highest in February, were closely and inversely correlated with growth of algae and macrophytes. (Cassar-FRC)
W83-02954

TOXICITY ASSESSMENT OF SNOWMELT WATER RUNOFF IN AN URBAN AREA (TOXICITE DES EAUX DE RUISSELLEMENT DE LA FONTE DE NEIGE EN MILIEU URBAIN),
Institut National de la Recherche Scientifique, Sainte-Foy (Quebec).
D. Couillard.
Water Research, Vol 16, No 7, p 1197-1205, July, 1982. 1 Fig, 3 Tab, 50 Ref. English summary.

Descriptors: *Bioassay, *Chlorophyta, *Water pollution effects, *Snowmelt, *Urban areas, Thaw, Rainfall, Surface runoff, Outfall sewers, Sewers, *Toxicity, Lead, Phosphorus, Chloride, Biochemical oxygen demand, Nitrate, Chromium, Zinc, Suspended solids, Inorganic compounds, Montreal, Quebec, Canada.

Bioassays were conducted on the green alga Selenastrum capricornutum to evaluate the composite effect of all pollutants occurring in waters originating from melting snow in urban areas. Also, the long-term bioavailability of selected toxicants in these waters was determined. A sampling study was performed on two outfalls of Montreal sewer systems of the combined surface runoff-wastewater type. Sampling was carried out in the spring of 1978 and was directed towards an analysis of flow-quality relationships during two dry and three snowmelt periods. Water quality parameters studied included: BOD5, COD, Cl(-), N, P, Pb, Cr, Zn, CN(-), and SS. Toxicological qualities of the outfalls were determined using a bioassay based on the fertility potential of Selenastrum capricornutum. An analysis of the relationship between chemical quality and the toxicological properties of the samples from both sewage networks indicated that water collected during snowmelt without rain had a greater potential for chronic toxicity and greater mean ratios of biomass after incubation in presence of EDTA to biomass without EDTA than combined water collected during dry weather. The toxicity resulted primarily from inorganic compounds. Rain during snowmelt apparently diluted the toxicants. (Small-FRC)
W83-02958

THE HEALTH SIGNIFICANCE OF VIRUSES IN WATER.
For primary bibliographic entry see Field 5F.
W83-02959

SOME CHEMICAL CHARACTERISTICS OF MINE DRAINAGE IN ILLINOIS,
Geological Survey, Urbana, IL. Water Resources Div.
For primary bibliographic entry see Field 5B.
W83-02971

DELINEATION AND HYDROLOGIC EFFECTS OF A GASOLINE LEAK AT STOVEPIPE WELLS HOTEL, DEATH VALLEY NATIONAL MONUMENT, CALIFORNIA,
Geological Survey, Sacramento, CA. Water Resources Div.
For primary bibliographic entry see Field 5B.
W83-02982

ATYPICAL MYCOBACTERIA ISOLATED AT CATANIA (MICROBATTERI ATIPICI ISOLATI A CATANIA),
Catania Univ. (Italy). Cattedra di Dermatologia Pediatrica.
For primary bibliographic entry see Field 5A.
W83-03009

HYGIENIC EVALUATION OF WATER POLUTED BY PESTICIDES ENTERING WATER BODIES IN SURFACE RUNOFF (GIGIENICHESKAYA OTSENKA VODY, ZAGRYAZNENNOI NEKOTORYMI PESTITSIDAMI PRI POSTUPLENII IKH V VODOEM S POVERKHNOSTNYM STOKOM),
Kiev Inst. for Developmental Matters (USSR).
P. I. Kosachevskaya.
Gigiena i Sanitariia, No 6, p 8-11, 1980. 3 Ref. English summary.

Descriptors: *Pesticides, *Surface runoff, *Oxidation, *Water pollution sources, *Agriculture, Agricultural runoff, Runoff, Water quality, Chloramp, Banvel-D, Chemical analysis, *USSR.

A formulation of the pesticides Chloramp and Banvel-D, when present in a body of water, activates biochemical oxidation processes to a greater degree than do the active principles of these pesticides in the same concentration. After entering a water body in a near-threshold concentration (as estimated on an organoleptic basis), the tested mixtures of pesticides will undergo biochemical oxidation, resulting in reduced levels of dissolved oxygen in the water and in a deteriorated sanitary condition of the water body. The treatment of plants with a mixture of these pesticides at rates of 0.3 kg/hectare of Chloramp and 5 kg/hectare of Banvel-D (the rates now considered to be most effective) may impair the water quality of the water body if the pesticides reach the water through surface runoff. (Author's abstract)
W83-03017

SOIL PORE STRUCTURAL STABILITY AND IRRIGATION WATER QUALITY: I. EMPIRICAL SODIUM STABILITY MODEL,
Natal Univ., Pietermaritzburg (South Africa). Dept. of Soil Science and Agrometeorology.
For primary bibliographic entry see Field 2G.
W83-03027

RADON, WATER, AND AIR POLLUTION: RISKS AND CONTROL,
Maine Univ. at Orono. Dept. of Physics and Astronomy.
C. V. Weiffenbach.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-206789, Price codes: A04 in paper copy, A01 in microfiche. Land and Water Resources Center Completion Report, Univ. of Maine, Orono, November 1982. 48 p, 14 Fig, 6 Tab, 1 Append, 60 Ref. OWRT A-057-ME(1), 14-34-0001-2121.

Descriptors: Air pollution, *Radiation, *Radioactivity effects, Water supply, Well water, *Maine, *Radon, Public health, Path of pollutants, Water pollution sources, Pollutant identification.

Summaries are presented on: (1) what is known about sources, levels, and health effects of radon; (2) how homeowners can have their water and air tested for radon; and (3) how radon levels in the home can be reduced. In Maine, radon levels were found to be highest in granitic regions (with well water averaging 22,000 pCi/1). Health risks from airborne radon are substantially greater than those from waterborne radon. It is estimated that a person living for sixty years in a house with an airborne radon level of 4 pCi/1 would have one chance in 100 of dying from lung cancer from that cause. The key factors affecting airborne radon levels in a home include (1) radon levels in well water, and water-using habits; (2) radon levels in soil gas, and type of construction of house and foundation; and (3) house ventilation rates. Effective control measures include use of activated carbon filters and increased ventilation pf the building.
W83-03031

STATISTICS OF SPECIES ABUNDANCE DISTRIBUTIONS IN MONITORING AQUATIC COMMUNITIES,
Idaho Univ., Moscow. Dept. of Forest Resources.
B. Dennis.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-206821, Price codes: A03 in paper copy, A01 in microfiche. Idaho Water and Energy Resources Research Institute Completion Report, Moscow, March 1983. 21 p, 22 Ref. OWRT A-085-IDA(1), 14-34-0001-2114.

Descriptors: *Aquatic environment, *Aquatic populations, *Species abundance distributions, *Aquatic biological communities, *Statistical methods, Statistical models, Probability, Water pollution effects, Model studies.

Statistical procedures were established for using species abundance distributions for monitoring pollution impacts in aquatic biological communities. The report synthesizes the statistical theory necessary for conducting inferences with community abundance data. Previous use of species abundance distributions by ecologists has relied on largely ad hoc analysis procedures. Instead, this report recommends: 1) the sampling distribution be fully specified, and 2) maximum likelihood (ML) techniques for parameter estimation be used. Two particular abundance distributions, the gamma and the lognormal, appear to be useful provided the above recommendations are followed. The so-called Canonical Hypothesis places restrictions on the parameter values for the gamma or lognormal models. This hypothesis can be explicitely tested for most data sets uing the ML estimation techniques. Other hypotheses that can be tested with these techniques are: 1) goodness-of-fit, for evaluating the model's description of the data, 2) two-sample for comparing two communities, and 3) likelihood ratio, for testing simple vs. complex models.
W83-03035

ULTRASONIC TELEMETRY STUDIES OF FISH ACTIVITY NEAR THE NANTICOKE THERMAL GENERATING STATION,
Ontario Ministry of Natural Resources, Port Dover.
N. G. MacLean, G. C. Teleki, and J. Polak.
Journal of Great Lakes Research, Vol 8, No 3, p 495-504, 1982. 5 Fig, 4 Tab, 32 Ref.

Descriptors: *Fish, *Thermal pollution, Heated water, Effects of pollution, Temperature effects, Waste heat, Thermal powerplants, *Lake Erie, Lakes.

Ultrasonic telemetry studies were conducted in 1973-77 to determine the effects of Nanticoke Thermal Generating Station's warmwater discharge on movement patterns of smallmouth bass, rock bass, and yellow perch. A total of 74 fish were tracked in the effluent plume and at control locations. These fish were monitored continuously, recording position, distance between turns, swim speed and angle of course alteration, as well as various environmental parameters. An activity index was developed to measure the overall level of fish activity. The measured activity of all three species was significantly lower within the plume than outside of it. Water depth appeared to be the most important factor determining fish activity, followed by wave height, current speed, and tem-

perature. Wave height, current speed, and temperature are directly affected by the thermal discharge. However, on closer examination, the response to the plume appeared to have been principally rheotactic. No long term residency in the plume was noted during this study or during concurrent make-recapture studies. (Baker-FRC)
W83-03074

IMPACT OF POWER PLANT ENTRAINMENT OF ICHTHYOPLANKTON ON JUVENILE RECRUITMENT OF FOUR FISHES IN WESTERN LAKE ERIE IN 1975-77,
Michigan Univ., Ann Arbor. School of Natural Resources.
R. L. Patterson, and K. D. Smith.
Journal of Great Lakes Research, Vol 8, No 3, p 558-569, 1982. 8 Tab, 20 Ref.

Descriptors: *Powerplants, *Entrainment, *Fish, Population dynamics, Population density, Model studies, Sampling, Ichthyoplankton, *Lake Erie.

The impact was assesssed of power plant entrainment of ichthyoplankton in western Lake Erie on juvenile recruitment to fish populations of the same region. Extensive ichthyoplankton surveys of western Lake Erie were conducted over a 3 yr period. Of the four species studied: gizzard shad, white bass, walleye, and freshwater drum, it was found that the effect on walleye year class strength is minimal, while the effect on gizzard shad recruitment may possibly be significant in terms of overall impact on the community ecology of the western basin. This aspect of the plant should be further studied. It was estimated that total juvenile recruitment of these four species would increase by 742 individuals per acre if all power plant entrainment were eliminated. (Baker-FRC)
W83-03075

THE RELATIONSHIP OF MINERALS COMMONLY FOUND IN DRINKING WATER TO ATHEROSCLEROSIS AND HYPERTENSION IN PIGEONS,
Oak Ridge Research Inst., TN.
N. W. Revis, R. L. Schmoyer, and R. Bull.
Journal of the American Water Works Association, Vol 74, No 12, p 656-659, December, 1982. 5 Fig, 3 Tab, 7 Ref.

Descriptors: *Public health, *Cardiovascular disease, *Minerals, Lead, Cadmium, Magnesium, *Hypertension, *Atherosclerosis, Pigeons, Calcium, Drinking water, Hardness.

The effects of Ca, Cd, Pb, and Mg in drinking water on cardiovascular disease were examined in white Carneau pigeons. The effects were expressed in terms of blood pressure and the presence and severity of atherosclerosis in pigeons from each of 16 experimental groups. The cardiovascular effects of Pb and Cd and the tissue levels of these elements depend on the level of Ca. The presence or absence of Mg did not significantly influence the cardiovascular effects of Pb or Cd following 24 months of exposure. If these results with the pigeons can be extrapolated to humans, the incidence of aortic atherosclerosis and hypertension should be significantly higher in geographic regions where there is a high intake of Pb and Cd and a low intake of Ca. The lack of a consistent and significant negative correlation between hard water and cardiovascular diseases may be the result of the relative level of Ca found in these hard waters. Harder water may reduce the intestinal absorption of Cd or Pb, which should result in a lower incidence of cardio vascular disease. (Baker-FRC)
W83-03081

EVALUATING POTENTIAL HEALTH RISKS OF CONSUMING REUSED WATER,
Chemical Industry Inst. of Toxicology, Research Triangle Park, NC.
R. A. Neal.
Journal of the American Water Works Association, Vol 72, No 12, p 638-641, December, 1982. 14 Ref.

Descriptors: *Public health, *Reclaimed water, Water supply, Water resources development, Drinking water, Potable water, Industrial wastes, Municipal wastewater, Wastewater treatment, Particulates, Asbestos, Metals, Organic compounds, Radiochemicals, Water reuse.

The possible adverse health effects caused by human consumption of reused water are surveyed, and suggestions for laboratory animal tests to evaluate chemical constituents of the water are outlined. Such analyses are needed before water treatment processes can be adjusted to accommodate reused water and monitoring procedures can be established to assure its safety. The major concern about reclaiming water for potable use is whether there is any significant health risk attributable to consumption of this water because of its bacteria, virus, or chemical content. The suspended particulate of greatest health concern is asbestos. Inorganic anions and cations of concern include sodium, arsenic, barium, cadmium, chromium, lead, mercury, silver, selenium, fluoride, nitrate, copper, iron, manganese, sulfate, and zinc. Methods are briefly described for evaluating acute toxic effects of inorganic chemicals, radiochemicals, particulates and organic chemicals; for evaluating subchronic effects of contaminants; and for evaluating chronic health effects as well. Teratogenicity and reproductive studies are needed along with tests of the effects on the immune system. The best continuous monitoring procedure to follow in regard to the introduction of new chemicals into the water supply is analytical monitoring of the supply and a continuous evaluation of new compounds introduced from industrial, agricultural, and household discharge into the source waters. (Baker-FRC)
W83-03086

TOXICOLOGICAL PROBLEMS ASSOCIATED WITH ALTERNATIVE METHODS OF DISINFECTION,
Health Effects Research Lab., Cincinnati, OH.
R. J. Bull.
Journal of the American Water Works Association, Vol 74, No 12, p 642-648, December, 1982. 7 Tab, 52 Ref.

Descriptors: *Disinfection, *Public health, *Drinking water, *Water treatment, Potable water, Chlorination, Chlorides, Chlorine dioxide, Chlorates, Trihalomethanes, Haloacetonitriles, Carcinogens, Monochloramine, Chlorites, *Toxicity.

Progress that has been made in the last several years in identifying toxicological hazards that are associated with alternate disinfectants themselves or with their reaction products is reviewed. These hazards can be associated with the disinfectants themselves as well as with the products formed when disinfectants such as chlorine, chlorine dioxide, and monochloramine and their by-products chlorite, chlorate, trihalomethanes, and haloacetonitriles are considered. The byproducts of chlorination that have been identified clearly possess carcinogenic properties. Chlorine dioxide possesses antithyroid activity. A substantial by-product of the use of chlorine dioxide, C102, produces hemolytic anemia. Monochloramine possesses mutagenic properties in bacteria and produces changes commonly associated with carcinogens in the livers of mice. Information is at present incomplete on the hazards associated with the formation of toxic by-products. More work is also needed in the area of formation of byproducts on ingestion of drinking water containing a residual disinfectant. Preliminary studies indicate that byproducts similar to those identified in drinking water are formed in vivo at high doses of disinfectant. How this source of byproducts compares with byproducts formed in water must be examined. Some studies suggest that alteration of the treatment conditions, such as alteration of pH or removal of precursors, may be as important an alternative in treatment as the disinfectant employed. (Baker-FRC)
W83-03087

EFFECT OF ATMOSPHERIC SULFUR POLLUTANTS DERIVED FROM ACID PRECIPITATION ON THE BENTHIC DYNAMICS OF LAKES,
State Univ. of New York, Syracuse. Coll. of Environmental Science and Forestry.
M. J. Mitchell.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-208322, Price codes: A03 in paper copy, A01 in microfiche. Center for Environmental Research Completion Report, Cornell Univ., Ithaca, N. Y., November 1982. 24 p, 10 Ref, 10 Append. OWRT B-096-NY(1), 14-34-0001-0235.

Descriptors: *Acid precipitation, *Adirondacks, *Benthos, Carbon-bonded sulfur, Chironomidae, Ester sulfate, Hexagenia, Insects, *Lakes, Microcosm, Organic sulfur, Pyrite, Radioisotopes, Secondary production, *Sediment, Sulfate, *Sulfur dynamics, Sulfuric acid, Air pollution, *New York.

Sulfuric acid is a major contributor to acid precipitation in the United States. The relationship of acid precipitation to the sulfur dynamics of three lakes in New York was studied. For South Lake, which has probably been acidified, the sulfur profile in the sediment corresponded to historical changes in anthropogenic sulfur inputs. In all three study lakes, the organic sulfur constituents, which generally have been ignored in limnological investigations, played a major role in sulfur dynamics. The transformations and fluxes of inorganic and organic sulfur differed among the lakes and reflected characteristic abiotic and biotic properties, including productivity parameters. The community structure and secondary production of the invertebrate benthos were ascertained and, for South Lake, were similar to other acidified lakes. The importance of benthic insects on sulfur dynamics was demonstrated. Further studies on sulfur in lakes will enhance the understanding of the role of these anthropogenic inputs on lake systems and permit a more accurate appraisal of the present and future impacts of acidic deposition on water quality.
W83-03093

AN ASSESSMENT OF THE ECONOMIC MAGNITUDE OF ENVIRONMENTAL DAMAGE FROM ACID PRECIPITATION IN THE ADIRONDACKS,
For primary bibliographic entry see Field 6B.
W83-03095

PREDICTION OF THE RESPONSE OF POND BIOTA TO ANIMAL WASTE FERTILIZATION,
Cornell Univ. Agricultural Experiment Station, Ithaca, NY. Dept. of Agronomy.
J. H. Peverly, and E. C. Moran.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-208835, Price codes: A03 in paper copy, A01 in microfiche. Center for Environmental Research Completion Report, Cornell Univ., Ithaca, N.Y., January 1983. 40 p, 1 Fig, 22 Tab, 38 Ref. OWRT A-087-NY(1), 14-34-0001-9034 and 1134.

Descriptors: Aquaculture, Ponds, *Digested dairy manure, Unionized ammonia, Fish, Aquatic production variability, Phosphorus, Nitrogen, Primary productivity, *Pond fertilization, Water pollution effects.

This study examined the production and water quality response of non-flowing ponds fertilized with anaerobically digested dairy manure at three fertilization rates: 5,500, 16,400, and 36,900 kg ha super -1 yr super -1 (wet weight). Primary productivity, the concentration of solids and fish yield (Micropterus salmoides and Notemigonus crysoleucas) were monitored in addition to N and P concentrations and fluxes. Primary productivity was increased by the manure inputs, to mean levels of 0.8-4.0 g C m super -2 day super -1 in the fertilized ponds versus 0.4-0.6 g C m super -2 day super -1 in the controls. The fish yield, however, was low in this study (0.1-1.1 kg ha super -1 day super -1) as compared to other manure-fertilized systems (5-40 kg ha super -1 day super -1). Microbial biomass supported by the organic substrates in the manure inputs contributed 17% of the total fixed carbon in these experiments. Calculations of N and P flux revealed that P limits production in the unfertilized ponds and in the low-rate ponds

(fertilized at 0 and 0.57 g P m super -2 yr super -1), but not in the moderate and high rate ponds (1.71 and 3.57 g P m super -2 yr super -1). N apparently limits production in these ponds. Both N and P are lost from the water column, but N is lost both more rapidly and more permanently from the pond system. The upper limits on pond fertilization rates are determined by water quality degradation from high ammonia concentrations which can be predicted as a function of manure load; thus, the upper limits on permissible manure inputs can be calculated.
W83-03103

FACTORS CONTROLLING BLUE-GREEN ALGAE DOMINANCE IN A SOUTHWESTERN RESERVOIR,
Oklahoma State Univ., Stillwater. Dept. of Zoology.
D. Toetz.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-208892, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Institute Completion Report, Oklahoma State Univ., Stillwater, 39 p, 12 Fig, 1 Tab, 22 Ref, 1 Append. OWRT A-106-OKLA(1), 14-34-0001-1138.

Descriptors: *Factor analysis, *Nitrogen fixation, *Nitrogen compounds, *Phosphorus compounds, Physiological ecology, *Phytoplankton, *Principal component analysis, Water quality management, Anabaena, Artifical lakes, Cyanophyta, Light intensity, Nitrogen cycle, Nitrogen, Nitrates, Orthophosphates, Algae, Ammonia, Anacystis, Aphanizomenon, Mathematical analysis, Microcystis, *Oklahoma, Lake Hefner.

Blue-green algae dominate eutrophic impoundments in summer and may contribute nitrogen (N) to the N budget of the lake through nitrogen fixation (NF). The objective of this study was to determine how NF was controlled by the environment and how it was correlated with changes in algal community structure in Lake Hefner, Oklahoma, during the summer of 1981. The contribution of biological nitrogen fixation to the nutrient budget was estimated. Horizontal, vertical, and diel changes in the rate of NF were described and input determined. Nutrient concentrations, light attenuation, chlorophyll a, dissolved oxygen, temperature and pH were measured. The effect of environmental variables on NF was examined through factor analysis. Phytoplankton present in pelagic samples were identified to the lowest possible taxa for information on species presence or absence. Summer, spring and occasional phytoplankton assemblages were identified using factor analysis. Ammonia was inversely related to nitrogen fixation rates. The percentage of heterocysts was high, but absolute densities of nitrogen-fixing algae and heterocysts were low, suggesting these algae were capable of nitrogen fixation but at low rates. Spring and summer phytoplankton assemblages of nuisance algae were identified. The two other assemblages consisted of rarer algae, primarily diatoms.
W83-03109

5D. Waste Treatment Processes

THE SUCCESSES OF INCREASED WASTEWATER TREATMENT PLANT CONSTRUCTION ON THE RHINE (ERFOLGE VERSTARKTEN KLARANLAGENBAUS AM RHEIN),
For primary bibliographic entry see Field 5G.
W83-02802

USE OF EPA'S CAPDET PROGRAM FOR EVALUATION OF WASTEWATER TREATMENT ALTERNATIVES,
Tulane Univ., New Orleans, LA. Dept. of Civil Engineering.
T. J. McGhee, P. Mojgani, and F. Vicidomina.
Journal of the Water Pollution Control Federation, Vol 55, No 1, p 35-43, January, 1983. 6 Fig, 3 Tab, 5 Ref.

Descriptors: *Model studies, *Economic evaluation, *Design criteria, Wastewater treatment, CAPDET model, Computer models, Jefferson Parish, *Louisiana, Alternative planning, Planning.

The CAPDET (Computer Assisted Procedure for the Design and Evaluation of Wastewater Treatment Facilities) program was developed by the U.S. EPA and U.S. Army Corps of Engineers for evaluating wastewater treatment alternatives. This model was applied to 208,000 combinations of flow, location, and effluent standards for the 210 sq km West Bank of Jefferson Parish, Louisiana, where a present population of 168,000 is served by 14 treatment plants of varying capacity and complexity. The top 20 alternatives selected by the model retained the same cost ranking when reanalyzed by more detailed desk top techniques. In this application the flaws of the procedure were: inability to calculate cost for large earthen basins used for aeration or equalization ponds, failure to produce satisfactory comminution and grit removal unit number default values at flows > 2 mgd, 35% underestimation of clarifier and sludge digester sizes, and 50-100% overestimation of annual aeration power costs. Despite these deficiencies CAPDET was considered a useful and economical technique ($1700 for 145 computer runs, excluding manpower). (Cassar-FRC)
W83-02804

TEAM EFFORT SOLVES OPERATIONAL PROBLEMS,
CH2M Hill Southeast, Inc., Gainesville, FL.
G. T. Daigger, G. A. Richter, J. R. Collins, and J. W. Smith.
Journal of the Water Pollution Control Federation, Vol 55, No 1, p 17-22, January, 1983. 6 Fig, 3 Tab, 6 Ref.

Descriptors: *Activated sludge process, *Contact stabilization, *Process control, Wastewater treatment, Memphis, *Tennessee, Aeration, Industrial wastewater, Municipal wastewater, Management, Performance evaluation, Sludge, Operating policies, Design criteria.

The North Memphis Wastewater Treatment Plant, Tennessee, a contact stabilization air activated sludge system, consistently failed to meet secondary treatment standards since beginning operation in August 1977. The plant was designed to treat a municipal wastewater influent of 245 mg per liter BOD, but the actual influent was a soluble, higher strength, readily biodegradable municipal/industrial wastewater with a BOD of 410 mg per liter. Two major problems were identified: insufficient aeration capacity, with poor control of dissolved oxygen concentrations, and inadequate sludge capacity. During an 18 month study operating criteria were developed for meeting treatment standards. These included a 3.5 day mean cell residence time based on the mixed liquor inventory in the contact and stabilization basins, a contact ratio of 1.0 g BOD per g mixed liquor suspended solids per day, a 4-6 hour stabilization basin hydraulic residence time, and total system oxygen requirements of 1.0 g per g BOD. These operating criteria improved plant performance so that the 30 mg per liter total suspended solids and 30 mg per liter BOD standards were violated only twice in 18 months during a period of excessive storm water inflow. A technical review committee, which included representatives from the city and industry, was formed to identify the major problems and potential solutions. An engineering firm was retained to execute the plans under the committee's direction. (Cassar-FRC)
W83-02805

KINETICS OF DISSIMILATORY NITRATE AND NITRITE REDUCTION IN SUSPENDED GROWTH CULTURE,
Rome Univ. (Italy). Dept. of Chemical Engineering.
M. Beccari, R. Passino, R. Ramadori, and V. Tandoi.
Journal of the Water Pollution Control Federation, Vol 55, No 1, p 58-64, January, 1983. 7 Fig, 3 Tab, 15 Ref.

Descriptors: *Kinetics, *Denitrification, *Inhibition, *Wastewater treatment, *Nitrates, *Nitrites, Biomass, Methanol, Chemical reduction, Nitrogen removal, Organic carbon, Nitrous acid, Biological treatment.

Nitrate and nitrite reduction kinetics were studied in suspended growth batch bench-scale tests under strictly controlled conditions. For nitrate reduction: (1) the maximum reduction rate was 0.32 mg nitrate-N per mg volatile suspended solids per day at 25C, pH of 7.5, and biomass concentration of 700-1000 mg volatile suspended solids per liter; (2) the half-saturation constant for methanol as a carbon source was about 30 mg per liter COD, limiting the reduction rate of nitrate with methanol when the concentration of organic carbon was < 40 mg per liter COD; (3) the reaction kinetics were zero-order even at low nitrate concentrations (< 1 mg N per liter) under non-carbon-limiting conditions. For nitrite reduction: (1) the maximum reduction rate was 0.52 mg nitrite-N per mg volatile suspended solids per day at 25C, pH of 7.5, biomass concentration of 500-1100 mg volatile suspended solids per liter, and nonlimiting nitrite concentrations; (2) nitrite concentrations that start inhibition were < 10 mg per liter nitrite-N for low biomass concentrations and increased with biomass concentration; (3) nitrite concentrations slightly above threshold values totally inhibited reduction; (4) inhibition may be a result of the presence of free nitrous acid. Denitrifying biomass was observed to acclimatize to nitrates. However, inhibition was irreversible, making the acclimatized biomass very vulnerable to fluctuations in influent nitrite concentrations. (Cassar-FRC)
W83-02806

MECHANISM OF CLARIFICATION FAILURE,
Olin Chemical Group, Charleston, TN.
V. D. Laquidara, and T. M. Keinath.
Journal of the Water Pollution Control Federation, Vol 55, No 1, p 54-57, January, 1983. 4 Fig, 1 Tab, 5 Ref.

Descriptors: *Clarification, *Activated sludge process, *Wastewater treatment, Clarifiers, Design criteria, Process control, Sludge thickening, Settling flux theory.

The settling flux/state point analytical approach (Keinath, et al., 1977) was used to analyze clarification failure function in secondary clarifiers. This theory was confirmed by continuous flow clarifier laboratory experimental results. Clarification failure should occur only when applied flux (Ga) exceeds the maximum flux (Gc). Failure progresses by propagation of a dilute blanket upward from the feed point and the simultaneous increase in feed concentration. Since Gc is always greater than the limiting flux for thickening (GL), the design of secondary clarifiers need not include a clarification failure criterion. Only Class I and II clarification and thickening failure criteria need be considered in the design. This ensures that stray activated sludge flocs are effectively removed. The capacitance against clarification failure can be increased by increasing the depth of submergence of the feed well and the overall clarifier depth. This provides for a greater retention time in the clarification portion of the clarifier and allows increased opportunity for aggregation of biological flocs. (Cassar-FRC)
W83-02807

INVESTIGATIONS ON THE ELIMINATION EFFICIENCY OF METAL HYDROXIDE FLOCS WHICH ARE MADE HYDROPHOBIC BY PRECIPITATION IN THE PRESENCE OF SODIUM STEARATE (UNTERSUCHUNGEN UBER DIE ELIMINATIONSWIRKUNG HYDROPHOBIERTER METALLOXIDHYDRATFLOCKEN),
Stuttgart Univ. (Germany, F.R.). Inst. fuer Siedlungswasserbau, Wasserguete- und Abfallwirtschaft.
R. Wagner, and W. Ruck.
Zeitschrift fuer Wasser und Abwasser Forshung, Vol 14, No 4, p 139-144, August, 1981. 9 Fig, 2 Tab, 11 Ref. English summary.

Descriptors: *Wastewater treatment, *Flocculation, *Sodium compounds, Soaps, Detergents, Separation, Adsorption, Coagulants.

The efficiency of using sodium stearate to enhance the effectiveness of metal hydroxide flocs used as coagulants was investigated. These tests showed that when aqueous solutions containing sodium stearate were treated with aluminum or ferric salts as coagulants, the stearate anions were almost totally eliminated from the solution. Synthetic detergents (anionics (ABS) or nonionics of the polyglycol ether types) were more completely eliminated from solutions containing sodium stearate from solutions not containing sodium stearate. This enhancement of flocculation results from the fact that the metal ions are partially precipitated in the presence of sodium stearate as the corresponding metal soaps. These metal soaps are hydrophobic in character and show a special affinity for sorption of amphiphilic compounds. The study also demonstrated the effect of the type and structure of individual detergents on the sorption process. (Author's abstract)
W83-02812

RESPONSE OF METHANE FERMENTATION SYSTEMS TO INDUSTRIAL TOXICANTS,
Drexel Univ., Philadelphia, PA. Environmental Studies Inst.
G. F. Parkin, R. E. Speece, C. H. J. Yang, and W. M. Kocher.
Journal of the Water Pollution Control Federation, Vol 55, No 1, p 44-53, January, 1983. 14 Fig, 4 Tab, 16 Ref.

Descriptors: *Anaerobic digestion, *Methane bacteria, *Toxicity, Fermentation, Industrial wastewater, Bacteria, *Wastewater treatment, Nickel, Sulfides, Ammonium, Formaldehyde, Water pollution effects.

The response of methane fermentation systems to industrial toxicants (nickel, ammonium, sulfide, and formaldehyde) was investigated using suspended growth systems and anaerobic filters seeded with acetate enrichment cultures. The extended periods of zero gas production (up to 20 days or 3 times the solids retention time in this study) after application of toxicants did not necessarily indicate destruction of methanogenic viability. Therefore, the system need not be totally cleaned and restarted in all cases of zero gas production. Recovery was accelerated when contamined liquid was removed. A large solids retention time served as a biological safety factor and allowed for acclimatization to the toxicant. Methane bacteria acclimated to all four toxicants. Acclimated bacteria were able to function without reduction in gas production at toxicant levels 2.4-12 times those causing inhibition in unacclimated methanogens. The wastewaters containing toxicants were most effectively treated in reactors with very high solids retention time and relatively low liquid retention time. Examples of these processes include anaerobic filters, anaerobic fluidized beds, anaerobic upflow sludge blankets, and anerobic rotating biological contactors. The threshold doses (concentrations that will result in the onset of decreased gas production) were: < 50 mg per liter for Ni and sulfide, < 100 mg per liter for formaldehyde, and < 2500 mg per liter for ammonia. (Cassar-FRC)
W83-02833

FLOTATION AS THE FINAL CLARIFICATION STEP IN WASTE-WATER TREATMENT AND ITS INFLUENCE ON THE OXYGEN BALANCE OF RECEIVING WATERS,
Karlsruhe Univ. (Germany, F.R.). Inst. fuer Siedlungswasserwirtschaft.
K. P. Kiefhaber, U. Neis, and J. Weber.
Water Science and Technology, Vol 14, No 9-11, p 1519-1520, 1982.

Descriptors: *Flotation, *Clarification, *Wastewater treatment, Oxygen balance, Receiving waters, Activated sludge process, Sludge, Dissolved oxygen, Biochemical oxygen demand.

A dissolved-air-flotation (DAF) pilot-scale unit was installed at a conventional municipal wastewater treatment plant with preliminary processes, primary sedimentation, activated sludge and final sedimentation. This municipal treatment plant worked at its design loading during the time of the study. The flotation unit worked in parallel with the sedimentation tank as the final clarification for the activated-sludge mixed liquor. The effluent quality data obtained from these studies were used as input parameters for calculations of the dissolved-oxygen content in streams, using a mathematical model for BOD reduction and reaeration. It was concluded that final clarification of wastewater using flotation improves the dissolved oxygen content of the effluent approximately twofold when compared with sedimentation. Under certain circumstances this effect can lead to avoidance of the dissolved-oxygen sag in receiving waters and promotion of self purification. (Baker-FRC)
W83-02848

THE APPLICATION OF PRETREATMENT PROCEDURES TO LIMIT MEMBRANE FOULING IN REVERSE OSMOSIS RECLAMATION OF SECONDARY SEWAGE EFFLUENTS,
National Inst. for Water Research, Bellville (South Africa). Cape Regional Lab.
H. A. De Villiers, G. R. Botha, and M. W. Wright.
Water Science and Technology, Vol 14, No 9-11, p 1521-1524, 1982. 1 Fig, 1 Tab.

Descriptors: *Reverse osmosis, Effluents, *Wastewater treatment, Reclamation, Water reuse, *Membrane fouling, *Pretreatment, *South Africa.

Early results are presented by the National Institute for Water Research in a new phase of an ongoing program to evaluate the use of reverse osmosis for reclamation of sewage effluents. The objective of the research is to develop a pretreatment process that will reduce the fouling potential of the secondary sewage effluent and will extend the useful life of the reverse osmosis membranes so as to achieve both technical and economic feasibility for this reclamation process. Additional objective included achieving by pretreatment a feedwater with a Plugging Index of less than 60%; restricting the flux decline of the reverse osmosis membranes to less than 20% per annum; and evaluating and developing other criteria whereby the fouling characteristics of the pretreated secondary sewage may be more satisfactorily quantified than by the Plugging Index. The main problem encountered has been the relatively short filter runs of about 12 to 16 hours. This implies a substantial wastage of water for back-washing and also necessitates undue down-time and operator attention. Results achieved thus far in the maintenance of acceptable product water output have been good but inconclusive due to the short operating period for the RO unit. With regular sponge balling and periodic chemical cleaning the flux decline rate has been held at an annual rate of about 15%. (Baker-FRC)
W83-02849

COMPUTER CONTROL IN A BIOLOGICAL SEWAGE PLANT, METHODS AND EXPERIENCE,
Contraga, Inc., Groebenzell (Germany, F.R.).
C. P. Kuznia.
Water Science and Technology, Vol 14, No 9-11, p 1538-1539, 1982.

Descriptors: *Computers, *Biological degradation, *Wastewater treatment, Microprocessors, Munich, Sludge, Activated sludge process, *Federal Republic of Germany.

Results are presented of an 18 month study of microprocessor control in a wastewater treatment plant near Munich, Germany. The city has about 200,000 inhabitants. The oxygen supply subsystem consists of two turbo blowers powered by gas motors and nine Roots blowers driven by electric motors, for a total air flow in the range of 4000 to 4200 cubic meters/h. The sludge from four secondary clarifiers flows into a tank from which the return and the excess sludge is extracted. The control strategy consists in conserving a suitable mass of micro-organisms in the aeration system and maintaining an acceptable mass flow ratio in the aeration basins. Microprocessor technology has now been accepted as a valid tool for process control. The multicom system is described as microcomputer network with decentralized processors for process control, suitable for decentralized plants. The system consists of a central computer in the main control room and two front-end computers out in the plant, one near the aeration tanks and the other in the pump-house. (Baker-FRC)
W83-02851

WATER AND WASTEWATER TREATMENT WITH REUSABLE MAGNETITE PARTICLES,
Commonwealth Scientific and Industrial Research Organization, South Melbourne (Australia). Div. of Chemical Technology.
N. J. Anderson, B. A. Bolto, D. R. Dixon, L. O. Kolarik, and A. J. Priestly.
Water Science and Technology, Vol 14, No 9-11, p 1545-1546, 1982. 1 Fig, 1 Tab, 5 Ref.

Descriptors: *Wastewater treatment, *Adsorption, *Magnetite process, Colloids, Drinking water, Industrial wastes, Dye industry, Heavy metals, Manganese, Zinc, Copper, Mercury, Cadmium, Algae, Bacteria, Virus.

A technique for the removal of negatively charged colloidal material and some soluble species from a raw water has been developed. The method is based on addition to the water of a pretreated finely sized magnetite slurry, which acts as a coagulent/adsorbent for colloidal material such as clays, humic acids, bacteria, viruses and algae. One of the achievements of the process development was the demonstration that results obtained in jar tests could be reproduced or even bettered in a continuously operating plant. Consequently, application of the process in the field of wastewater treatment is being actively investigated at the jar test level. When applied to a dyehouse effluent the method adsorbed water soluble yellow and red dyes. For paper machines, white water turbidity was reduced and color was reduced without adding to the total dissolved solids. For secondary sewage treatment, phosphate ions were removed and turbidity and color lessened. For heavy metal contaminated water, Mn, Zn, Cu, Hg, and Cd were absorbed. For algae removal the process was efficient over a range of conditions. Bacteria and virus removal was also effective; their concentrations were reduced by a factor of 100 to 10000. (Baker-FRC)
W83-02852

A SYSTEM DEVELOPED FOR THE TREATMENT OF TANNING AND OTHER PROTEINACEOUS EFFLUENTS,
Silverton Tannery Ltd. (South Africa).
S. D Roets.
Water Science and Technology, Vol 14, No 9-11, p 1547-1548, 1982.

Descriptors: *Wastewater treatment, *Proteins, *Tannery wastes, Industrial wastes, *South Africa, Flocculation, Chemical coagulation, Dispersants, Sulfides.

Design criteria were developed for dissolved air flotation, which was found to be the most cost effective method for treatment of tannery effluents in South Africa. In all instances it was necessary to pre-aerate the wastewater for the removal of sulfides, since ferric chloride was used as the primary flocculant. The addition of a manganese salt was needed to act as a catalyst for the complete oxidation of the sulfides. An air saturator was replaced with a continuous foam generator when the system was placed in full scale operation, which would provide a stable foam acting as floc support in order to promote efficient solids removal. The Silflo System was introduced, whereby some of the clear effluent of the flotation unit is recycled for the production of foam. The foam generated as a result of the mixing of air with an acidified effluent contains proteinaceous material. The process is extremely suitable for the treatment of tannery wastewater, but can be extended to treat other types of effluents as well. Results are promising for treatment of wastewater from abattoirs,

chicken processing, general meat processing, paper mills, wetblue plants, fellmongeries and pig slurries. The total solids, sulfide and chromium in tannery waste water can be reduced by more than 98%, while 70% of the COD and BOD is removed as well. (Baker-FRC)
W83-02853

RESEARCH INTO THE MASS CULTURE OF ALGAE IN CLOSED SYSTEMS,
Orange Free State Univ., Bloemfontein (South Africa). Inst. of Environmental Sciences.
R. D. Walmsley, S. N. Shillinglaw, and D. Geldenhuys.
Water Science and Technology, Vol 14, No 9-11, p 1569-1570, 1982.

Descriptors: *Algal growth, *Cultures, *Wastewater treatment, Biological degradation, Culture media, Growth media, Culturing techniques, Closed systems, Plastic.

A study was conducted involving a re-evaluation of closed systems, following a consideration of the possible benefits which could be obtained by linking closed algal culture systems with ethanol fermentation units for the production of protein and the treatment of nutrient-rich effluents from fertilizer factories. Studies were made of algal cultures in the laboratory and outdoors in both miniponds and a larger channel-type pond. Cultures of naturally developing algae were grown outdoors semi-continuously on a combination of industrial urea, superphosphate and tapwater. Minipond experiments involving a comparison on the performance of open and closed cultures have established that the enclosure of ponds with transparent plastic stimulates production to a certain extent. Production in the 100 sq m pond during midsummer was extremely low because of the extremely high temperatures which developed. Rotifer infestations were found to be a major problem, and sedimentation of algal cells was excessive. The development of an organic sludge on the channel floors provided an ideal environment for the development of Chironomid larvae, whose emergent adult stages aggregated under the plastic cover, both perpetuating and intensifying the problem. During winter, production in the 100 sq m pond increased above summer values because of the more favorable thermal regime. Enclosure with plastic reduced evaporation rate from greater than 10 mm/day to almost zero. (Baker-FRC)
W83-02854

PHYSICAL-CHEMICAL METHODS OF TREATMENT FOR OIL-CONTAINING EFFLUENTS,
Societe Degremont, Rueil-Malmaison (France).
F. Berne.
Water Science and Technology, Vol 14, No 9-11, p 1995-1207, 1982. 5 Fig, 7 Tab, 4 Ref.

Descriptors: *Oil industry, *Wastewater treatment, *Physiochemical treatment, Industrial wastes, Water pollution sources, Hydrocarbons, Oil spills.

The effluents from pipe-line terminals, de-ballasting units and refineries still contain, after a preliminary oil-removal by gravity in various types of oil-separators, significant residual hydrocarbon concentrations as stable emulsions varying from 25 to 300 mg/liter. It is necessary to submit these effluents to a polishing oil-removal process. Such processes, often called physical-chemical treatment, remove the residual, insoluble hydrocarbons and leave the soluble hydrocarbons only. Practically, depending on the case considered, the final total hydrocarbon content should not exceed from 5 to 20 mg/liter. For this, there are several techniques based on dissolved air flotation or filtration. These processes and their results are summarized. The selection of the appropriate physical-chemical process will be effected either, according to the origin of the effluents, which could give a probable, but not certain, indication as to the anticipated composition of effluents, or preferably from a knowledge of actual data about existing effluents. (Baker-FRC)
W83-02855

PRODUCTION OF ALGAL PROTEIN IN RAW SEWAGE,
National Inst. for Water Research, Pretoria (South Africa).
For primary bibliographic entry see Field 3C.
W83-02856

LOW-COST TECHNOLOGY FOR WATER POLLUTION CONTROL IN DEVELOPING COUNTRIES,
National Inst. for Water Research, Pretoria (South Africa).
G. G. Cillie.
Water Science and Technology, Vol 14, No 9-11, p 1337-1352, 1982. 4 Fig, 3 Tab, 8 Ref.

Descriptors: *Water pollution control, *Developing countries, *Wastewater treatment, *Education, Management, Training, Technology transfer, Water management.

Approximately 80% of all illness in developing countries is related to water in one way or another. The United Nations has begun the International Water Decade. Using low cost technology, the aid planned in this program would cost approximately $100,000 million. Details are given of the design and methods of construction of units which are best suited to the specific requirements and which would be simple, reliable and economical to operate. These can be constructed largely from local materials and by local labor. The need for training of water treatment personnel cannot be overstated. It has often been experienced that an expensive plant and equipment become completely ineffective after only one year of operation due to the neglect of lubrication instructions. On the average more than half of all public water supply schemes in rural and urban fringe areas of developing countries were no longer functioning three years after commissioning. The main danger of any technology being rejected lies in the loss of confidence which may easily occur if a scheme fails soon after implementation. Water treatment plants should preferably be of a nature which enables construction by local unskilled labor. It is stressed that the simplest possible type of equipment compatible with local requirments should be used in each instance, and that the training of the technical personnel and education of the local inhabitants should receive the highest priority. (Baker-FRC)
W83-02858

THE ROLE OF CONSULTANTS,
Vanderbilt Univ., Nashville, TN.
W. W. Eckenfelder, Jr.
Water Science and Technology, Vol 14, No 9-11, p 1279-1280, 1982.

Descriptors: *Planning, *Technology transfer, Wastewater treatment, Wastewater treatment facilities, Design criteria, Management, Decision making, Evaluation.

Two separate cases must be examined in considering the role of consultants in technology transfer: municipal water pollution control and industrial water pollution control. The industrial case would consider industrial wastewater treatment plants or publically owned treatment works with large industrial inputs. It is not seen as feasible to apply results obtained for biological treatment of municipal wastewater to most industrial categories. Technology transfer needs to be restricted to wastewaters of similar chemical composition. With respect to nitrification, the large amount of data presently available permits technology transfer from one situation to another with a high degree of confidence. A new dimension in the water pollution control field recently has been the identification of priority pollutants. Innovative approaches are needed in many areas including source control, and modifications in existing technology such as PAC T, or the addition of powdered activated carbon to the aeration basins and the addition of chemical coagulants to the biological process. The economics of wastewater treatment have drastically changed over the past few years. (Baker-FRC)
W83-02860

SCALE-UP PROBLEMS,
Watson Hawksley, London (England).
J. M. Sidwick.
Water Science and Technology, Vol 14, No 9-11, p 1269-1277, 1982. 19 Ref.

Descriptors: *Planning, *Design criteria, *Wastewater treatment, Wastewater treatment facilities, Pilot plants, Biological treatment.

Consideration is given to some of the problems of the scale-up of wastewater treatment processes from bench scale and from pilot scale to full scale. An attempt is made to put the question of scale-up problems into perspective by reference to the experience of the author and the work of others reported in the literature. Treatments are considered to be classified as chemical, physical and biological in nature. It is concluded from the experiences of the author that the bench-scale work of the research often can not be scaled up with the reliability implied. A bench-scale plant usually needs to be developed into a reasonable pilot scale to simulate the full scale plant, and even then it does not always succeed. Nothing is as good as full scale operation, and often the interpretation of less than full scale work is heavily influenced by full scale operational experience. Finally, the researcher generates the concepts, which may or may not work in practice. The designer and the operator will see whether they work, and will learn much more about the mechanisms of the process thereby. (Baker-FRC)
W83-02861

THEME 4: TECHNOLOGY TRANSFER: REPORT OF THE SESSION CONVENOR,
Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.).
S. H. Eberle.
Wate Science and Technology, Vol 14, No 9-11, p 1261-1267 11 Ref.

Descriptors: *Technology transfer, Planning, Water management, Water treatment, Wastewater treatment, Biological wastewater, treatment, Sludge treatment, Activated sludge process.

Aspects discussed under wastewater technology transfer included scale-up problems, the role of participants in the technology transfer process, the need for involvement of practitioners in research and planning, packaging of information in technology transfer programs. Technology transfer was defined as a complex process with proper scale-up or down as the main technical factor and adequate information transfer as well as an end-scaled view in research and development. One very important field in technology transfer is the application of modern technology in the so-called developing countries. Scale-up problems were considered for chemical treatment, physical treatment, biological treatment, and sludge treatment. Consultants play a key role in technology transfer. The function, organization and importance of the equipment supplier is highly variable from one country to another, and it is thus difficult to present a general concept of his role in technology transfer. The need of individual effort on the part of one seeking information is stressed as necessary before any transfer of information can take place. (Baker-FRC)
W83-02872

WATER POLLUTION CONTROL IN DEVELOPING AREAS: PROBLEMS AND NEEDS,
For primary bibliographic entry see Field 5G.
W83-02876

SUPPRESSION OF DENSITY WAVES IN CLARIFIERS,
Waterloo Univ. (Ontario). Dept. of Chemical Engineering.
For primary bibliographic entry see Field 8B.
W83-02880

THE ROLE OF DOC, UV ABSORPTION AND TOH MEASUREMENTS IN WATER POLLUTION CONTROL,
National Inst. for Water Research, Pretoria (South Africa).
R. A. van Steenderen.

Water Science and Technology, Vol 14, No 9-11, p 1535-1537, 1 Fig, 3 Ref.

Descriptors: *Water pollution control, *Sampling, Water analysis, *Pollutant identification, Measuring, Dissolved oxygen, *Ultraviolet absorption, *Organo-halogen potential, *Organic carbon.

A highly successful unit process which has become an integral part of water purification is that of active carbon adsorption, which serves as a final polishing step to remove color and odors but which above all reduces the amount of organic compounds in the final water. The adsorption capacity of active carbon is not unlimited, and periodic assessments of its condition and effective lifespan are needed. An alternative and less complicated method than determining the life expectancy of the carbon itself is to monitor the quality of the outflow of the carbon column in terms of parameters such as dissolved organic carbon DOC based on wet chemical photooxidation of a sample with infrared detection of the carbon dioxide liberated and total organohalogens TOH based on coulometric titration principles. Pilot plant studies whereby activated sludge plant effluent was passed through columns containing Filtrasorb 300 active carbon illustrated that regular DOC measurements could serve as early indications of carbon column breakthrough. A 12-month quality survey of Pretoria drinking water saw further application of DOC, TOH, and UV measurements, including a relatively new concept called the total organohalogen potential value where samples were overchlorinated and left for 48 hr before analysis. With the exception of TOH, positive inter-correlations existed between DOC, TOH, and UV measurements for a specific water, and the significance of these correlations was dependent on water quality consistency. It was furthermore found that the correlation between DOC and UV values was seasonally dependant. (Baker-FRC)
W83-02882

PARASITES IN SOUTHERN SLUDGES AND DISINFECTION BY STANDARD SLUDGE TREATMENT,
Tulane Univ., New Orleans, LA. School of Public Health and Tropical Medicine.
For primary bibliographic entry see Field 5B.
W83-02887

IMPROVING DESIGN OF A DOMESTIC WASTE DISPOSAL SYSTEM USING AN UNSATURATED FLOW MODEL AND PHOSPHORUS ADSORPTION,
Maine Univ. at Orono. Dept. of Civil Engineering.
W. F. Brutsaert, W. E. Hedstrom, and J. D. McMillan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-196527. Land and Water Resources Center Completion Report, Univ. of Maine at Orono, February, 1983. 63 p, 15 Fig, 2 Tab, 43 Ref, 1 Append. OWRT A-50-ME(1), 14-34-0001-9021, -0121, -1121.

Descriptors: *Adsorption, Domestic wastes, Effluents, Groundwater movement, Mathematical models, Model studies, Numerical analysis, *Phosphorus, Septic tanks, Soil water, *Unsaturated flow, Water pollution sources, Path of pollutants, Fate of pollutants, Waste disposal.

A two-dimensional unsaturated flow model including hysteresis was developed to study movement and distribution of domestic septic tank effluent in a mound system. The objective was to improve design by maximizing phosphorus adsorption. Earlier laboratory studies by McNiece (1978) and Foster (1982) indicated that phosphorus adsorption increases substantially with decreasing saturation. Simulation runs of this study, therefore, focused on the maximization of effluent spreading for given mound dimensions, thereby minimizing saturation beneath the trench. Significant results are that hysteresis effects are minor for long-term simulation; that most of the flow (around 75%) and hence most of the P-adsorption in a typical single-trench mound with homogeneous backfill occurs directly below the trench; that the life of a mound with respect to phosphorus adsorption could be extended 2.6 times by dividing the effluent flow between two parallel trenches; and that inserting a soil layer of lower permeability and finer pore size below the single trench could increase the expected phosphorus sorption lifetime 2.1 times.
W83-02900

WASTEWATER STABILIZATION LAGOON EFFLUENT UPGRADING WITH MODIFIED INTERMITTENT SAND FILTERS,
Missouri Univ.-Rolla. Dept. of Civil Engineering.
D. E. Modesitt, and G. W. Shaffer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-196642, Price codes: A05 in paper copy, A01 in michrofiche. Missouri Water Resources Research Center Univ. of Missouri, Columbia, November 1982. 86 p, 22 Fig, 15 Tab, 21 Ref. OWRT A-134-MO(1), 14-34-0001-2127.

Descriptors: *Oxidation lagoons, *Sewage lagoons, *Sewage effluents, *Filters(Intermittent sand), *Wastewater treatment, Water pollution control, Biochemical oxygen demand, Chemical oxygen demand, Nitrogen, Phosphorus, Filtration, Field crops(Residue), Harvesting of Algae, Sanitary engineering, Environmental engineering.

Field studies were performed to evaluate the use of intermittent sand filters (ISF) modified with an overlay of corn stalk residue for upgrading wastewater lagoon effluent. An unmodified control filter was also evaluated. Hydraulic loading of 4700 m super 3/ha-d (0.5 mgad) was applied. Influent and effluent measurements were made of BOD sub 5, COD, TKN, TSS, VSS, Total Phosphorous and pH. Data is presented in tabular and graphical form. A modified filter which had a layer of synthetic drainage fabric between the sand and stalks produced a longer filter run before clogging and superior effluent quality than the other modified filter and slightly better or approximately equal performance as compared with the unmodified filter. The following are average influent/effluent values (mg/l) over a ten week period: BOD sub 5 51/15, COD 148/35, TSS 119/6, VSS 97/4, TKN 11/3, total p 2.2/2.6, pH 9.1/7.2. Modified filters restricted the depth of clogging to the top 2.5 cm (1 in) of the sand compared with depths up to 7.6 cm (3 in) in the conventional filter. The overall performance of the modified ISF, while satisfactory was not significantly better than that of the conventional ISF in this study.
W83-02902

COAGULATION AND REMOVAL OF ALGAL SUSPENSIONS FROM WASTEWATER STABILIZATION PONDS,
Missouri Univ.-Columbia. Dept. of Civil Engineering.
J. T. O'Connor, J. T. Novak, and Y. Jalali-Yazdi.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-196659, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Center Completion Report, Univ. of Missouri, Columbia, April 1983. 43 p, 28 Fig, 1 Tab, 8 Ref. OWRT A-135-MO(1), USDI-OWRT-14-34-0001-2127.

Descriptors: *Algae, *Coagulation, *Algal population trends, *Bacterial population trends, Zeta(Electrokinetic) potential, Stabilization ponds, Lagoons, Stabilization ponds, *Wastewater treatment, Zeta meter.

The zeta (electrokinetic) potential of algal surfaces results from interaction of physicochemical properties of the medium with those of algal surface. Thus, the zeta potential of algae depend on the chemical composition of medium and the growth dynamics of the species. Bacterial growth is an intergral part of algal growth. The interwoven population dynamics of the two organisms constitute their symbiosis. Light periodicity induces drastic population fluctuations of algae and bacteria. Comprehensive algal removal methods depend on understanding and manipulation of the relationship between algae and bacteria.
W83-02903

AUTOMATION STUDY OF ACTIVATED SLUDGE PROCESSES,
Puerto Rico Univ., Mayaguez. Dept. of Civil Engineering.
N. H. Tang.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-202291, Price codes: A04 in paper copy, A01 in microfiche. Puerto Rico Water Resources Research Institute Completion Report, Univ. of Puerto Rico, Mayaguez, April 1983. 52 p, 20 Fig, 1 Tab, 13 Ref. OWRT A-062-PR(1), 14-34-0001-1141.

Descriptors: *Activated sludge, *Control systems, Domestic wastes, *Automation, *Wastewater treatment.

This study is divided into the following parts: (1) a summary of the existing control strategies, (2) an evaluation of the control strategy selected for detailed analysis, and (3) the development of a fully automatic control system for the activated sludge biological treatment process. The use of the solids flux curve for the dynamic-state control of a completely mixed activated sludge process has been analyzed in detail. From the analyses carried out, the following conclusions can be drawn: (1) the new approach for dynamic-state control of activated sludge processes is both practically feasible and theoretically sound, (2) for practical purposes, constant C sub o for the control equation can be considered a good approximation, (3) the solids flux curve needs to be renewed periodically, (4) a technique is offered for minimizing the loss of sludge into the effluent under extraordinary surge flow conditions, (5) the integration of this control approach into plant automation has a very promising future.
W83-02909

LABORATORY STUDY OF DYNAMIC-STATE CONTROL OF ACTIVATED SLUDGE PROCESSES,
Puerto Rico Univ., Mayaguez. Dept. of Civil Engineering.
N. H. Tang.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-202309, Price codes: A03 in paper copy, A01 in microfiche. Puerto Rico Water Resources Research Institute Completion Report, Univ. of Puerto Rico, Mayaguez, April 1983. 41 p, 17 Fig, 7 Tab, 5 Ref. OWRT A-066-PR(1), 14-34-0001-1141.

Descriptors: *Activated sludge, *Control systems, Domestic wastes, *Wastewater treatment, *Sludge treatment.

A laboratory study on using the solids flux curve for the dynamic-state control of a completely mixed activated sludge process was carried out. Activated sludge of a municipal sewage treatment plant was transported to the laboratory. First, the g and h values of the sludge settling characteristics were determined; then using these values together with the values of the sludge suspended solids concentration and the surface area of the settling tank, a sludge recycle rate was calculated for a given influent flow rate. The laboratory activated sludge treatment unit was operated with various influent flow rates and their respective calculated sludge recycle flow rates. Several conclusions have been drawn from this laboratory study. Firstly, the concentration profile in the settling column demonstrates again the typical profile exhibited during the period when the clarifier-thickener is operated at the fully-loaded condition. Secondly, the solids distribution between the aeration tank and the settling tank should remain at stable condition if the thickener is operated at the fully-loaded condition. Lastly, the new control approach should be tested at a small sewage treatment plant.
W83-02910

VOLATILIZATION OF ORGANIC TRACE CONTAMINANTS BY AIR STRIPPING FOR WATER RECLAMATION,
Stanford Univ., CA. Dept. of Civil Engineering.
P. V. Roberts, G. D. Hopkins, C. Munz, and A. H. Riojas.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-202374,

Price codes: A06 in paper copy, A01 in microfiche. Office of Water Research and Technology Report OWRT/RU-82/11, U.S. Dept. of the Interior, Washington, D.C., December 1982. 106 p, 41 Fig, 13 Tab, 73 Ref, 10 Append. OWRT C-90235-R(No. 0474)(1), 14-34-0001-0474(1).

Descriptors: *Wastewater treatment, *Water treatment, *Organic compounds, *Aeration, *Chlorinated hydrocarbons, *Mass transfer, Air stripping, Trace organics.

This research was undertaken to assess the validity of the chemical engineering unit operations approach for characterizing the performance of countercurrent air stripping in a packed column as a means of separating volatile organic solutes from aqueous solution. The experiments were conducted in a small packed column under laboratory conditions controlled to assure a stringent test of the unit operations models. Mass transfer models frequently applied in the chemical engineering literature were tested, using as a criterion the ability to simulate and to predict organic solute removal in a laboratory packed column. Mass transfer models based on semi-empirical correlations that account for the resistances in both the liquid and gas phases were found to predict adequately the observed column performance. Indeed, good agreement between prediction and experiment was found even under conditions outside the range in which the mass transfer correlations previously had been validated. Only in extreme cases where the stripping factor was less than unity did the agreement between theory and observation deteriorate, and such exceptional cases are not of practical interest for treatment applications. Based on this work, it is justified to use the customary chemical engineering approach for design of countercurrent, packed-column air strippers for water reclamation.
W83-02917

A THEORETICAL AND EXPERIMENTAL INVESTIGATION OF THE DYNAMICS OF BREAKPOINT CHLORINATION IN DISPERSED FLOW REACTORS,
California Univ., Los Angeles. School of Engineering and Applied Science.
For primary bibliographic entry see Field 5F.
W83-02926

NITRIFICATION PROCESS IN A PACKED BED REACTOR WITH A CHEMICALLY ACTIVE BED,
Polish Academy of Sciences, Zabrze. Inst. of Environmental Engineering.
E. Kowalski, and Z. Lewandowski.
Water Research, Vol 17, No 2, p 157-160, February, 1983. 3 Fig, 8 Ref.

Descriptors: *Calcium carbonate, *Nitrification, *Neutralization, *Wastewater treatment, Marble, Hydrogen ion concentration, Alkalinity, Oxidation, Ammonium, Nitrates.

Crushed marble used as a packing material in a wastewater nitrification reactor neutralized the hydrogen ions formed by bacterial metabolism, maintaining the effluent pH of 6-8 for about 160 days, compared with about 50 days for an inert gravel bed. No other alkalinity control was necessary. The 170 mg per liter ammonium-N influent was oxidized in one step with 95% efficiency for 180 days, after which the pH dropped to less than 4 and efficiency started to decrease. (Cassar-FRC)
W83-02947

RATE CONSTANTS OF REACTIONS OF OZONE WITH ORGANIC AND INORGANIC COMPOUNDS IN WATER--I. NON-DISSOCIATING ORGANIC COMPOUNDS,
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschultz, Duebendorf (Switzerland).
For primary bibliographic entry see Field 5F.
W83-02950

RATE CONSTANTS OF REACTIONS OF OZONE WITH ORGANIC AND INORGANIC COMPOUNDS IN WATER--II. DISSOCIATING ORGANIC COMPOUNDS,
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschultz, Duebendorf (Switzerland).
For primary bibliographic entry see Field 5F.
W83-02951

A KINETIC MODEL OF STEADY STATE PHOSPHORUS FIXATION IN A BATCH REACTOR--IV,
Florida Univ., Gainesville. Dept. of Agricultural Engineering.
A. R. Overman, R. L. Chu, and B. R. McMahon.
Water Research, Vol 17, No 1, p 15-19, January, 1983. 7 Fig, 1 Tab, 6 Ref.

Descriptors: *Kinetics, *Phosphorus, *Wastewater treatment, Model studies, Adsorption, Batch reactors.

A kinetic model was developed to describe phosphorus fixation in a batch wastewater treatment reactor. It included adsorption, transformation, decomposition, and reaction. The model described steady state fixation and the dependence of the maximum rate of fixation and of the rate factor on soil mass/solution volume ratio. Sites for adsorption and transformation behaved in a catalytic manner, either by regeneration of sites or by generation of new sites. About 99% of the transformed phosphate was apparently unstable. The remaining 1% was probably either an essentially insoluble colloidal aluminum phosphate or iron phosphate. (Cassar-FRC)
W83-02952

THEORETICAL AND EXPERIMENTAL STUDY OF FACTORS AFFECTING CAPILLARY SUCTION TIME (CST),
Tokyo Inst. of Tech. (Japan). Dept. of Environmental Chemistry and Engineering.
H. Unno, H. Muraiso, and T. Akehata.
Water Research, Vol 17, No 2, p 149-156, February, 1983. 10 Fig, 5 Ref.

Descriptors: *Sludge filters, *Filter rate, *Capillary suction time, Dewatering, *Wastewater treatment, Sewage sludge, Filtration.

Factors affecting capillary suction time in sewage sludge were studied in theory and by experiment. A device for measuring linear capillary suction time (LCST), simpler than conventional radial equipment, was developed. The LCST was correlated with the specific resistance to filtration of sludge when the product of specific resistance and cake mass deposited per unit volume was greater than a critical value. Below these critical values, the LCST was not well correlated with filterability, but correlated with solid concentration of the suspension. (Cassar-FRC)
W83-02955

EDTA AS A KINETIC INHIBITOR OF COPPER(II) SULFIDE PRECIPITATION,
Maryland Univ., College Park. Dept. of Chemistry.
For primary bibliographic entry see Field 5B.
W83-02956

EXPOSURE TO MICROBIAL AEROSOLS FROM ACTIVATED SLUDGE TREATMENT,
Hawaii Univ., Honolulu. Water Resources Research Center.
A. W. Lam, and H. F. Young.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-208579, Price codes: A04 in paper copy, A01 in microfiche. Technical Report No 145, November 1982. 63 p, 12 Fig, 20 Tab, 41 Ref. OWRT A-088-HI(1), 14-34-0001-1113.

Descriptors: *Bioindicators, *Public health, Wastewater treatment, Path of pollutants, *Hawaii, Activated sludge process, Pathogens, Pollutant identification, Coliforms, *Microbial aerosols, Wahiawa sewage treatment plant, Pearl City Wastewater Treatment Plants.

Viable pathogens are generally present at every stage of wastewater treatment. Thus a potential airborne infectious pathway due to microbial aerosols exists, particularly at activated sludge treatment plants. In this study the concentration of sewage borne indicator bacteria and viruses in effluent aerosols was determined and the exposure to such aerosols by treatment plant workers was estimated. Initial aerosols collection with fog-gage screen collectors yielded erratic results due especially to lack of control over sampled air volume and slit openings too large for effective collection. Standard Andersen and glass impinger collectors were used throughout the field study. Areas downwind of aeration basins yielded as much as 1 657 CFU/m super 3 total bacteria and 1.8 PFU/m super 3 coliphage. These aerosols were mostly 2.1 to 3.3 um droplet nuclei with a high potential for inhalation and bronchial retention. The inhalation of microbial aerosols by Wahiawa treatment plant workers was estimated to be between 48 to 94 total bacteria/person/day above background levels. The inhaled total coliform level may average 8 to 27 CFU/person/day. This usually short duration and sometimes intense exposure could not be implicated directly to cause adverse health effects. Correlations of statistical tabulations of sick-leave illness with degree of exposure were not significant at the 0.01 or the 0.05 level.
W83-03097

SOLAR HEATING OF WASTEWATER STABILIZATION PONDS,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
S. L. Klemetson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-208603, Price codes: A05 in paper copy, A01 in microfiche. Colorado Water Resources Research Institute Completion Report No 121, Colorado State University, Fort Collins, March 1983. 91 p, 29 Fig, 5 Tab, 35 Ref, 2 Append. OWRT A-046-COLO(2), 14-34-0001-9006 and 0106.

Descriptors: *Stabilization ponds, *Wastwater treatment, *Wastewater disposal, *Solar heating, Heated water, Water temperature, Model studies, Computer models, Dissolved oxygen, Biochemical oxygen demand.

Performance of wastewater stabilization ponds or sewage treatment lagoons is dependent upon pond water temperature. In recent years there has been considerable interest expressed in raising pond water temperatures in an effort to improve performance of the treatment process. Solar heat may be one energy source useful in raising pond water temperatures. In this study the experimental models were designed using a computer model to assess the effect of adding solar heat to waste stabilization ponds. Six model ponds were constructed and sewage water temperatures in both heated and unheated control systems were analyzed. The experimental ponds showed an average temperature increase of 4.7C (8.5 F) over that of the unheated control pond during the test period using a solar collector effective area equal to pond surface area. Pond surfaces were kept ice-free during the daylight hours. By adding heat at the bottom of the ponds it was possible to increase temperatures and dissolved oxygen levels throughout the depth of the ponds.
W83-03100

EFFECT OF OZONATION ON THE BIODEGRADABILITY AND ADSORBABILITY OF SPECIFIC ORGANICS TO BE REMOVED IN THE 'BIOLOGICALLY ACTIVATED CARBON (BAC)' PROCESS,
Massachusetts Univ., Amherst. Water Resources Research Center.
F. A. DiGiano, S. F. McShane, and M. F. Lorenzo.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-208876, Price codes: A06 in paper copy, A01 in microfiche. Publication No 135, December 1982. 109 p, 31 Fig, 17 Tab, 34 Ref, 1 Append. OWRT A-132-MASS(1), 14-34-0001-0123.

Descriptors: *Wastewater treatment, *Ozonation, *Activated carbon, *Biological treatment, *Organic carbon, *Organic compounds, *Biodegradation, Advanced wastewater treatment, Activated sludge process, Oxygen uptake, Biological oxidation, Biochemical tests, Substrates, Sorption, Adsorption, Acids, Phenols, Isotherms.

Phenol, 2,4 dinitrophenol, paranitrophenol, benzoic acid and ortho-, meta- and parachlorobenzoic acid were ozonated and changes in the adsorption isotherm were measured. Gilson respirometry studies were conducted using unozonated solutions of phenol and benzoic acid in order to measure the availability of sorbed substrate for biodegradation. Similar studies with ozonated solutions examined the effect of ozonation on the biodegradability and availability of sorbed substrate. Even at low ozone dosages, the adsorption isotherm, as measured by the total organic carbon of the mixture, was in most cases different than that of the parent compound; adsorption was decreased but there were also exceptions. Competitive adsorption between the residual parent sorbate and the low concentration(s) of by-products of ozonation was suggested but not proven. Sorbed substrate was shown to be available for biodegradation. Ozonation of phenol increased oxygen uptake substantially in flasks containing activated carbon, but not in flasks containing sand. In the absence of sorbed substrate, ozonation may not necessarily lead to increased oxygen uptake if the effect of ozonation is to lower the stoichiometric amount of oxygen required for biodegradation.
W83-03107

THE EFFECT OF AERATION BASIN CONFIGURATION ON ACTIVATED SLUDGE BULKING AT LOW ORGANIC LOADING,
California Univ., Berkeley. Sanitary Engineering Research Lab.
S. -E. Lee, B. L. Koopman, D. Jenkins, and R. F. Lewis.
Water Science and Technology, Vol 14, No 6/7, p 407-427, 1982. 12 Fig, 4 Tab, 23 Ref.

Descriptors: *Activated sludge process, *Bulking sludge, *Aeration basins, Organic loading, Sludge thickening, Anaerobic conditions, *Wastewater treatment, Richmond, *California, Laboratory studies.

Continuous flow laboratory scale activated sludge units were operated using domestic sewage from Richmond, California, at low ratios of food to microorganisms (F/M). In the F/M range of 0.05-0.25 g COD removed per g total mixed liquor volatile suspended solids (TMLVSS)-day, bulking did not occur with a low BOD (139 mg per liter) sewage feed and TMLSS of 1.5 g per liter. Addition of raw sludge (total BOD of the mixture, 315 mg per liter) increased the TMLSS to 3.5 g per liter. Bulking occurred in the 2, 4, 8, and 16 compartment units. An aeration basin with an initial compartment 1/32 of the aeration basin volume prevented, but did not cure, bulking. An aeration basin with initial compartments 1/74 of aeration basin volume prevented and cured bulking. Anoxia in an aeration basin with 2 initial compartments each 1/64 of the total volume did not cure bulking. The sludge volume index of sludges produced at low F/M and high TMLSS were dependent on conditions in the initial compartment rather than those in the remainder of the aeration basin. Soluble COD, F/M, and the size of the first compartment were important factors controlling bulking; floc loading, dispersion number, and total number of aeration basin compartments were not important. (Cassar-FRC)
W83-03120

AEROBIC THERMOPHILIC STABILIZATION OF SLUDGE VERSUS ANAEROBIC DIGESTION AND OTHER KINDS OF SLUDGE TREATMENT AT MIDDLE-SIZED PLANTS WITH RESPECT TO POWER CONSERVATION AND ECONOMY,
Bayerisches Landesamt fuer Wasserwirtschaft, Munich (Germany, F.R.).
P. Wolf.
Water Science and Technology, Vol 14, No 6/7, p 727-738, 1982. 8 Fig, 6 Tab, 5 Ref.

Descriptors: *Sludge handling, *Wastewater treatment, *Cost analysis, Financial aspects, Sludge digestion, Anaerobic digestion, Conservation, *Federal Republic of Germany.

Operating data concerning energy balances were collected by a state bureau from a sewage treatment plant with aerobic-thermophilic stabilization and also from plants with anaerobic sludge digestion and energy recovery. On the basis of these data, power and heat balances as well as cost-benefit calculations have been obtained for treatment plants of different sizes with different biological and sludge treatment processes. In spite of high and rising energy costs in plants using the aerobic-thermophilic stabilization process, the results show an overall economic benefit for this process at small and middle sized treatment plants compared to those using anaerobic sludge digestion. The evaluation of data indicates that this economic benefit is due to high capital costs and low efficiency of energy recovery under process conditions at small and middle-sized plants applying anaerobic digestion. (Baker-FRC)
W83-03121

THE PERFORMANCE OF AN ULTRAFILTRATION PILOT-PLANT FOR THE CLOSED LOOP RECYCLING OF TEXTILE DESIZING EFFLUENTS,
Natal Univ., Durban (South Africa).
C. A. Buckley, R. B. Townsend, and G. R. Groves.
Water Science and Technology, Vol 14, No 6/7, p 705-713, 1982. 3 Fig, 3 Tab, 6 Ref.

Descriptors: *Wastewater treatment, *Recycling, *Textiles, Textile mill wastes, Industrial wastewater, Filtration, Ultrafiltration, Closed loop recycling.

The results of sixteen months' operation of an ultrafiltration pilot plant for the closed loop treatment and recylcing of textile desizing effluent containing polyvinyl alcohol are described. Operation in the batch concentration and continuous modes is compared. Data on the effects of feed temperature, reject flow rate, size concentration and membrane cleaning on the permeate production rate are presented. The environmental impact and economics of a full-scale plant are discussed. Trials have demonstrated that excellent results can be obtained from the closed loop treatment and recycle of desizing effluents containing PVA size. Ultrafiltration membrane performance was consistent, and adequate cleaning techniques were developed to prolong membrane lifetime. It is estimated that the installation of the closed loop recycle system will reduce the water consumption of the textile mill by 19,000 cubic meters per year and reduce the annual chemical oxidation demand pollution load by 900 tons. (Baker-FRC)
W83-03123

AN INTEGRATED LOW COST SYSTEM FOR TREATMENT OF POTATO PROCESSING WASTERWATER INCORPORATING ANAEROBIC FERMENTATION AND PHOSPHORUS REMOVAL,
Water Science Labs. Pty Ltd., Melbourne (Australia).
J. G. Parker, B. J. Lyons, and C. D. Parker.
Water Science and Technology, Vol 14, No 6/7, p 675-687, 1982. 4 Fig, 7 Tab, 10 Ref.

Descriptors: *Wastewater treatment, *Food-processing wastes, *Fermentation, Methane, *Anaerobic conditions, *Phosphorus removal, Phosphorus, Sludge disposal, Fertilizers, Land disposal, Industrial wastes.

The pollution load from a modern potato processing plant represents a substantial wastewater treatment and disposal problem with considerable potential for process innovation. A low-cost area integrated system for treatment of all process wastewaters, incorporating treatment of high strength wastes by anaerobic fermentation and phosphorus removal facilities, has been developed from pilot plant studies. This plant offers considerable potential for application to treatment of other food processing wastes. The system incorporated anaerobic methane fermentation phosphorus removal processes. Operating data have indicated consistent achievement of an overall BOD5 removal efficiency of 90% and an overall phosphorus removal efficiency of 93%. Total annual treatment cost is about $0.15/kg BOD5 removed. The anaerobic fermentation process has major cost advantages over conventional processes for treatment of high organic strength industrial wastes with minimal land area requirement and low energy requirement. Disposal of residual phosphorus sludge to land has demonstrated the excellent fertilizer value of this sludge and the prudent use of a valuable agricultural resource. (Baker-FRC)
W83-03124

SIMULTANEOUS PASTEURIZATION - DIGESTION (SPD-PROCESS),
Niersverband, Viersen (Germany, F.R.).
G. Kugel.
Water Science and Technology, Vol 14, No 6/7, p 739-748, 1982. 4 Fig, 21 Ref.

Descriptors: *Sludge digestion, *Wastewater treatment, Sludge, Pasteurization, Digestion, Thermophilic digestion, Organic matter, Degradation, Niers River basin, Federal Republic of Germany.

As part of the regional sludge disposal system of recycling to land, which is integrated into the Niers river basin management of the Niersverband, F pasteurization is done in combination with the anaerobic stabilization of sludge in order to ensure long term agricultural disposal in agreement with hygienic standards, which is in general much less expensive than any other alternative for sludge handling and disposal. During the past 15 years of Niersverband activity in liquid sludge recycling, pasteurization has been done after digestion. This pasteurization step has now been successfully placed before the anaerobic stabilization step, with sufficient gas yield, organic matter degradation and stable low concentration of organic acids in the digester at a positive gas energy balance. Further optimization has reduced energy loss consumption, especially at the recooling stage. At larger sewage treatment plants coupling of the spd-process with electric energy generation by a gas engine or gas turbine seems to be of high interest because the hot flue gas from that side can be used at low pressure for submerged combustion heating of sludge. The spd-process could also be favorable for thermophilic digestion or for step digestion at a thermophilic and a following mesophilic stage. Thus a further impetus for development of anaerobic stabilization may be expected in the near future. (Baker-FRC)
W83-03125

INHIBITION MODELING IN ANAEROBIC DIGESTION,
Aveiro Univ. (Portugal).
A. C. Duarte, and G. K. Anderson.
Water Science and Technology, Vol 14, No 6/7, p 749-763, 1982. 11 Fig, 5 Tab, 14 Ref.

Descriptors: *Anaerobic digestion, *Wastewater treatment, *Inhibition, Mathematical studies, Mathematical equations, Propionic acid.

The effects of volatile acids and pH on anaerobic digestion were studied in laboratory and pilot-scale digesters. The wall growth was shown to be an important parameter when operating digesters at low solid concentrations. Inhibition of the anaerobic digestion process was noted at pH values below 6.3 or at unionized volatile acid concentrations of 10 to 25 mg/1 as acetic acid. Wall growth plays an important role during the operation of laboratory scale digesters at low solids concentration. Propionic acid utilization can become the rate limiting step in anaerobic digestion of soluble wastes for certain specific conditions. The usual pH changes during digester operation require the use of sophisticated models, even to predict the steady state. At constant pH, however, the Monod model should suffice. The effects of pH and volatile acids can be satisfactorily described by available models of anaerobic digestion. (Baker-FRC)
W83-03126

ELEMENTS OF THE INHIBITION OF NITRIFYING BACTERIA,
Rennes-1 Univ. (France). Lab. of the Chemistry of Water and the Environment.
G. Martin, and Y. Richard.
Water Science and Technology, Vol 14, No 6/7, p 781-794, 1982. 11 Fig, 4 Tab, 14 Ref.

Descriptors: *Nitrification, *Bacteria, *Wastewater treatment, *Inhibition, Organic compounds, Metals, Heavy Metal, Toxicity, Minerals, Nitrates, Oxidation, Ammonia.

Laboratory experiments were conducted on ammonia bio-oxidation to nitrates by mixed culture of nitrifiers in order to quantify the influence of mineral and organic pollutants on biokinetics parameters. The inhibitory effects of various heavy metal ions were studied using laboratory scale activated sludge and submerged filter units. Depending on the unit process and the metal involved, inhibitory effects are observed at concentrations above 1 mg/1. Results obtained provide further support for an hypothesis suggested as an explanation of the toxicity of compounds such as heavy metals. This theory is based on a Freundlich adsorption law of heavy metals on nitrifying sludge. No change in inhibitory effects is obtained using fixed films in submerged filters. The effects of organic compounds were examined using the same laboratory procedure. Inhibitory effects of organic compounds in submerged filters depend on their absorptive property. Each of the organic compounds involved may effect nitrifying bacteria. (Baker-FRC)
W83-03127

GRANULAR ACTIVATED CARBON AND PREOZONATED GRANULAR ACTIVATED CARBON TREATMENT FOR BIOLOGICALLY AND PHYSICALLY-CHEMICALLY TREATED WASTEWATER EFFLUENTS,
Texas Univ. at Dallas, Richardson. Graduate Program in Environmental Sciences.
A. Netzer, and J. L. McNutt.
Water Science and Technology, Vol 14, No 6/7, p 619-627, 1982. 2 Fig, 4 Tab, 8 Ref.

Descriptors: *Wastewater treatment, *Activated carbon, *Ozonation, Pretreatment, Municipal wastewater, Industrial wastes, Ozone, Disinfection, Hydrogen sulfide, Texas, Garland.

Problems in the operation and implementation of granular activated carbon systems for the combined biological and physical-chemical treatment of effluents at the Duck Creek Wastewater Treatment Plant prompted the design and construction of a pilot plant facility composed of 5 pilot plant systems. This facility provides for evaluation of simultaneous granular activated carbon treatment and preozonated granular activated carbon treatment for biologically, physically-chemically, and blended treated wastewater effluents. The pilot plant facility has been in operation since November 1979, demonstrating the improved operation and treatment efficiency of preozonated granular activated carbon treatment for these effluents. The study has shown that the preozonated granular activated carbon treatment systems provided superior treatment efficiencies in almost all parameters compared to the granular activated carbon treatment systems treating the same wastewater effluents. While the average period of operation for the granular activated carbon treatment systems before exdhaustion was 70 days, the preozonated granular activated carbon treatment systems operated nearly 300 days without exhaustion. Production of hydrogen sulfide was non-existent in the preozonated granular activated carbon system. The pressur^ of this gas was evident in the area of the nonpreozonated granular activated carbon systems. (Baker-FRC)
W83-03128

AN IN SITU COMPARISON OF THE EFFECTIVENESS OF FOUR ALGICIDES,
Ott Water Engineers, Inc., Anchorage, AK.
R. W. Hoffman, G. Bills, and J. Rae.
Water Resources Bulletin, Vol 18, No 6, p 921-927, December, 1982. 4 Fig, 2 Tab, 36 Ref.

Descriptors: *Algicides, *Alkaline water, *Equalizing basins, Ponds, *Wastewater treatment, Herbicides, Simazine, Diuron, Copper citrate, Copper ethanolamine, Bioassays, Chelation, Stabilization ponds, Wastewater lagoons, Industrial wastewater, *Colorado.

The effectiveness of four algicides was evaluated by in situ bioassays in a wastewater equalization pond at the R. D. Nixon Power Generating Station, Colorado Springs, Colorado, during August-September 1980. This water had pH of 9.2, total dissolved solids of 610 mg per liter and high nutrient concentrations. The order of effectiveness of the chemicals was simazine > diuron > copper ethanolamine > copper citrate. Tests were conducted in clear 60-liter plastic bags suspended in the ponds. Three concentrations (on the order of 0.05-3.0 ppm) of each chemical were tested. Additions were made on August 26 and again on September 11. Effectiveness was measured in terms of chlorophyll a, productivity, and algal counts. Although simazine was rated more effective than diuron, the concentrations tested in this study were not equivalent, 0.5-3.0 ppm simazine and 0.05-1.0 ppm diuron. The copper algicides were not as effective in this alkaline water because free copper is not freely available in the pH range of the pond water. (Cassar-FRC)
W83-03137

5E. Ultimate Disposal Of Wastes

THERMAL PRETREATMENT OF SLUDGES--A FIELD DEMONSTRATION,
R. T. Haug, T. J. LeBrun, and L. D. Tortorici.
Journal of the Water Pollution Control Federation, Vol 55, No 1, p 23-24, January, 1983. 3 Fig, 3 Tab, 10 Ref.

Descriptors: *Sludge digestion, *Anaerobic digestion, *Heat treatment, Sludge thickening, Sludge conditioning, Digestion, Pretreatment of sludge, Dewatering, Pathogens, Bacteria, Energy, Odor control, Thermophilic digestion.

The concept of thermal pretreatment of primary and waste activated sludges followed by anaerobic digestion was demonstrated in a pilot-scale facility over a 16 month period. The apparatus consisted of a trailer-mounted thermal conditioning system, a 45.4 cu m complete mix digester, and several dewatering devices to evaluate the effectiveness of the conditioning/digestion. Thermal pretreatment at a temperature of 171 to 218C did not significantly affect digester performance. Compared with conventional thermal conditioning, the thermal pretreatment/anaerobic digestion system produced less degradable COD recycle to the wastewater treatment plant, produced a favorable energy balance, improved odor control in dewatered cake solids and liquor sidestreams, reduced the amount of solid for final disposal, and completely destroyed pathogens. (Cassar-FRC)
W83-02831

MORTALITY PATTERNS OF INDICATOR ORGANISMS DURING AEROBIC DIGESTION,
Black and Veatch, Denver, CO.
R. D. Kuchenrither, and L. D. Benefield.
Journal of the Water Pollution Control Federation, Vol 55, No 1, p 76-80, January, 1983. 3 Fig, 4 Tab, 10 Ref.

Descriptors: *Bacteria, *Sludge digestion, *Aerobic digestion, Fate of pollutants, Indicators, Digestion, Pathogens, Streptococcus, Staphylococcus, Coliforms, Land application, Temperature effects.

The fate of indicator organisms during aerobic digestion at temperatures in the upper mesophilic range was investigated. Fecal coliforms, streptococci, and staphylococci concentrations were determined through the aerobic digestion process at 20, 30, and 40C, at 5, 8, 12, 15, 25, and 35 days. In general, fecal coliforms and fecal streptococci concentrations decreased with time; the rate of decrease was higher at higher temperatures. The times required to reach the digested sludge stage (destruction of bacteria) were: fecal coliforms, 15 days at 20C, 8 days at 30C, and zero at 40C; fecal streptococci, 15 days at 20C, 10 days at 30C, and 7 days at 40C. Data for staphylococci were less easy to analyze numerically. The organisms appeared to adapt to the 20 and 30C temperatures and subsequently propagate. These effects were less pronounced as temperatures increased. At 40C, adaptation, but not progagation, took place; numbers were not materially reduced after 35 days digestion. (Cassar-FRC)
W83-02834

THE ENUMERATION OF STREPTOCOCCI AND MYCOBACTERIA PRESENT IN LANDFILL LEACHATE,
Cincinnati Univ., OH. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 5B.
W83-02885

THE SURVIVAL OF BACTERIAL INDICATORS IN LYSIMETERS AND LANDFILLS,
Cincinnati Univ., OH. Dept. of Civil and Environmental Engineering.
J. A. Donnelly, P. V. Scarpino, and D. Brunner.
Water Science and Technology, Vol 14, No 9-11, p 1558-1559, 1982.

Descriptors: *Landfills, *Bacteria, *Leachates, Waste dumps, Municipal waste, Bacteria, Enterobacter, *Fate of pollutants, Moisture content.

The presence of pathogenic bacteria and pathogenic bacterial indicators was determined in leachate and solid waste from two 2-year-old lysimeters, one of which contained municipal solid waste and the other hospital waste, and also from a full scale landfill containing municipal solid waste that was 9 years old. The solid waste and leachate within lysimeter D, exposed after 2 years, was examined at three descending levels. The total coliforms, fecal coliforms, fecal coliforms, and fecal streptococci were all present in the top solid waste level at concentrations of 1300, 90, and 71,000 MPN/100 g, respectively. At the upper levels (5 feet) within the solid waste of the Boone County landfill the fecal indicators decreased, and then increased to significant concentrations at 8.5 to 10.5 feet. The total coliform, fecal coliform, and fecal streptococci concentrations were 35,000, 400, and 35,000 MPN/100 g of solid waste. The leachate within the landfill also demonstrated high bacterial concentrations and contained total coliform, fecal coliform, and fecal streptococci levels of 9,200, 350, and 110 MPN/100 ml. Also at the landfill several types of gram-negative rods were isolated. It was concluded that the landfill conditions differ significantly from the surrounding soil, as determined by the presence of large numbers of fecal indicator bacteria, high conductivity, and a high percentage of moisture. It is this latter quality of the waste that has probably been important in maintaining the long microbial survival in the landfill. (Baker-FRC)
W83-02886

IMPROVING DESIGN OF A DOMESTIC WASTE DISPOSAL SYSTEM USING AN UNSATURATED FLOW MODEL AND PHOSPHORUS ADSORPTION,
Maine Univ. at Orono. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W83-02900

WASTE FROM THE WATER TREATMENT PLANT AT ALTON AND ITS IMPACT ON THE MISSISSIPPI RIVER,
Illinois State Water Survey Div., Champaign.
R. Evans, T. Hill, D. Schnepper, and D. Hullinger.
ISWS Circular 156, 1982. 62 p, 16 Fig, 13 Tab, 12 Ref.

Descriptors: *Water treatment, *Water treatment facilities, *Solid wastes, *Bottom sediments, Rivers, Clarification, Aluminum, Iron, Aquatic life, Silt, Sand, Wastewater outfall, Chemical wastes, Macroinvertebrates, Sludge solids, Bottom sampling, *Illinois, Mississippi River, Alton.

Treating Illinois' public water supplies produces a quantity of wastes, which are mostly solids in the suspended and dissolved form at concentrations higher than the raw water being treated. The two principal sources of waste from the treatment plants are basin sludge and from backwash operations. This study attempted to determine the quantity and characteristics of wastes produced in a moderate-sized treatment plant employing the clarification process, and to assess any effects of the discharge on a large river. The Alton plant generates about 12,500 pounds of waste solids per day. The major chemical constituents are iron and aluminum. Except during 7-day, 10-year low flow conditions, increases in suspended solids in the Mississippi River during occurrences of maximum waste discharges will not be perceptible. Wastes are detectable in bottom sediments by increases in iron, aluminum, moisture, and volatile content, but only about 200 feet offshore and within 2000 feet downstream of the waste outfall. The composition of sand-silt-clay relationships also changed within the impacted area, with a higher ratio of silt and a lower ratio of sand. However, there was no measurable blanket of sludge deposits. Without these deposits and with no evidence that the iron and aluminum concentrations are toxic to aquatic organisms, sediment changes in the impacted area do not indicate environmental degradation. All sampling stations were classified as polluted or semi-polluted. Near-shore sediments, including those in the impacted area, supported a higher density and diversity of macroinvertebrates than any of the other locations, due to the silty-sand bottom sediments. (Atkins-Omniplan)
W83-02920

NUMERICAL SIMULATION OF FLOW AND CONTAMINANT MIGRATION AT AN EXTENSIVELY MONITORED LANDFILL,
Waterloo Univ. (Ontario). Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W83-02942

GEOLOGIC AND WELL-CONSTRUCTION DATA FOR THE H-7 BOREHOLE COMPLEX NEAR THE PROPOSED WASTE ISOLATION PILOT PLANT SITE, SOUTHEASTERN NEW MEXICO,
Fenix and Scisson, Inc., Tulsa, OK.
For primary bibliographic entry see Field 4B.
W83-02977

NEW METHOD SIMPLIFIES SLUDGE DISPOSAL.
Journal of the American Water Works Association, Vol 74, No 4, p 110-111, April, 1982. 3 Fig, 1 Ref.

Descriptors: *Sludge disposal, *Water treatment, *Land application, Land disposal, Air diffusion sludge liquefaction.

The air diffusion method of liquefying water treatment sludge overcomes some of the problems of sludge handling and disposal. This patented system consists of a pumping station to transfer the sludge from solids-contact basins, storage tanks with air diffusion grids, a compressed air blower, and a tank truck sludge hauler. Air is blown through the sludge in the storage tanks to liquefy it for easy transfer to the hauling truck. There it is mixed by compressed air during transit to farm land. Sludge of 46% dry solids (calcium and magnesium carbonates) is spread uniformly in a 0.8 m wide swath. The air diffusion system may be readily fitted to any size water treatment plant. (Cassar-FRC)
W83-03070

WASTEWATER INJECTION WELL PROBLEMS, PROCESSES AND STANDARDS,
Hawaii Univ. at Manoa, Honolulu. Water Resources Research Center.
J. A. Oberdorfer, and F. L. Peterson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-208827, Price codes, A07 in paper copy, A01 in microfiche. Technical Report No 146, December 1982. 141 p, 42 Fig, 22 Tab, 36 Ref, 8 Append. OWRT A-093-HI(1), 14-34-0001-2113.

Descriptors: *Injection well, *Wastewater disposal, *Clogging, Groundwater, Field tests, Filtration, Carbonates, *Hawaii, *Nitrogen gas binding.

Near-well processes, their relationship to clogging, and technology appropriate under Hawaiian hydrogeologic conditions for dealing with clogging were examined in this study. The first phase involved monitoring of functioning injection well systems on Oahu and pointed out deficiences in the areas of (1) site selection, (2) well design and construction, (3) injection well testing, (4) effluent quality control, (5) injection well monitoring and maintenance, and (6) injection well redevelopment. Monitoring of existing injection sites furthermore pointed out the need for construction of experimental injection well systems where more detailed studies could be made of injection clogging mechanisms. The second phase involved construction and operation of experimental injection well systems to investigate problems of injection well siting, design, testing, and redevelopment. Results show the need for selection of high initial injection capacity sites, standardization of injection testing to predict maintainable injection capacity, and well redevelopment. The third phase involved examination of near-well clogging processes and their implications for injection well operation and redevelopment. Results show that filtration of suspended solids is not a long-term cause of clogging as is generally cited in the literature. It is probably a short-term cause at the start-up of effluent injection. As injection continues, however, the microbial biomass becomes established and biodegrades the injected organic particulates. During the same period denitrifying bacteria become sufficiently established to produce significant amounts of nitrogen gas, which in turn produces a gas-bound zone about 0.5 to 1 m out in the injection stratum as revealed by the injection head gradient. Initially, most of the head loss is immediately adjacent to the well, but after several weeks it shifts to a region over 1/2 m from the well. With continued injection the nitrogen gas-bound zone slowly extends itself farther out into the injection stratum. Superimposed on this, but its effects masked in part by the gas binding, is dissolution of the carbonate porous medium.
W83-03102

AEROBIC THERMOPHILIC STABILIZATION OF SLUDGE VERSUS ANAEROBIC DIGESTION AND OTHER KINDS OF SLUDGE TREATMENT AT MIDDLE-SIZED PLANTS WITH RESPECT TO POWER CONSERVATION AND ECONOMY,
Bayerisches Landesamt fuer Wasserwirtschaft, Munich (Germany, F.R.).
For primary bibliographic entry see Field 5D.
W83-03121

LEACHING CHARACTERISTICS OF INDUSTRIAL METAL FINISHING WASTEWATER TREATMENT PLANT SOLIDS,
Whirlpool Corp., Benton Harbor, MI.
T. H. Goodgame, and P. W. Barnett.
Water Science and Technology, Vol 14, No 6/7, p 715-726, 1982. 7 Fig, 6 Tab, 3 Ref.

Descriptors: *Wastewater disposal, *Heavy metals, *Leaching, *Landfills, Waste dumps, Sanitary landfills, Metals, Metal finishing wastes, Industrial wastes.

The leaching characteristics of solids resulting from the treatment for discharge of wastewaters produced by typical large metal finishing facilities were determined. Samples were chosen so that the full range of both manufacturing processes and products produced was covered. The primary processes which contributed to the wastewater for treatment were phosphating in preparation for organic coating and pickling in preparation for application of porcelain enamel. These samples, along with a sandy loam soil as a control, were placed in lysimeters. Distilled water was used as the leaching liquid, selected as most representative of landfill conditions. Liquid was passed through the samples at the rate of one liter per week. Based on the area of the lysimeter this rate was equivalent to a percolation rate of 510 cm per year. Leachate samples were analyzed for twenty-two different parameters: pH, TSS, COD, alkalinity, chloride, nitrate, phosphate, sulfate, Al, B, Ca, Cd, Cr, Cu, Fe, Mg, Mn, Na, Ni, Pb, Ti, and Zn. Results indicate that the wastewater solids act very similarly to the soil used as a control. The leachate concentrations of heavy metals and the depletion of the heavy metals were such that this material would create no problems if disposed in an ordinary landfill, indicating that it is neither toxic nor hazardous. The time period of this experiment was equivalent to ten years of exposure in an ordinary landfill, and to a much longer period if deposited in a sanitary landfill. (Baker-FRC)
W83-03122

AN INTEGRATED LOW COST SYSTEM FOR TREATMENT OF POTATO PROCESSING WASTERWATER INCORPORATING ANAEROBIC FERMENTATION AND PHOSPHORUS REMOVAL,
Water Science Labs. Pty Ltd., Melbourne (Australia).
For primary bibliographic entry see Field 5D.
W83-03124

SIMULTANEOUS PASTEURIZATION - DIGESTION (SPD-PROCESS),
Niersverband, Viersen (Germany, F.R.).
For primary bibliographic entry see Field 5D.
W83-03125

PROCESS INTEGRATION IN SLUDGE MANAGEMENT,
Cornell Univ., Ithaca, NY. School of Civil and Environmental Engineering.
R. I. Dick, D. L. Simmons, and Y. Hasit.
Water Science and Technology, Vol 14, No 6/7, p 765-779, 1982. 8 Fig, 1 Tab, 32 Ref.

Descriptors: *Sludge disposal, *Ocean dumping, *Incineration, Costs, Wastewater treatment, Design criteria, Systems analysis, Model studies, Cost analysis.

Complex interactions occur between individual sludge treatment processes and other sludge management processes. Sludge treatment processes also interact with wastewater treatment processes. Consideration of those interactions has been facilitated by a computerized optimization scheme using models of process performance and cost based on fundamental design and operational variables. It was determined that the mean cell residence time of activated sludge processes and the retention time of anaerobic digesters should, with current energy costs, be as short as possible while assuring satisfactory operation. The additional cost of larger gravity thickeners is often offset by savings in anaerobic digestion and other process costs. The method by which sludge is transported to a point ultimate disposal has an important effect on identification of the lowest cost technique for sludge management. Based on available cost information, ocean disposal, where feasible, is nearly always costs effective, and sludge combustion is not. The cost of energy significantly affects optimal design of sludge treatment processes. (Baker-FRC)
W83-03135

5F. Water Treatment and Quality Alteration

SANITARY PROBLEMS IN RELATIONSHIP WITH TAP WATER DISTRIBUTED IN NEW OR RECENT BUILDINGS OF PARIS (PROBLEMS SANITAIRES POSES A PARIS PAR L'EAU POTABLE DANS LES IMMEUBLES NEUFS OU RECENTS),
Laboratoire d'Hygiene de la Ville de Paris (France).
A. M. Laurent, G. Montout, A. Spinasse, and B. Festy.
Techniques et Sciences Municipales, No 5, p 319-322, March, 1981. 4 Fig, 10 Ref. (No English Summary).

Descriptors: *Potable water, *Water distribution, *Impaired water quality, Water pollution sources, *Bacteria, Metals, *France, Paris.

New buildings in Paris, France, have been experiencing problems with the quality of their potable water. In many cases, there has been a degradation in tap water quality during the first few years following occupancy of new buildings. The relationship between technical sanitary controls of building installations and an analytical survey of the water distributed to 674 buildings in Paris was studied in 1979. The results demonstrate a relatively high percentage of high-level bacterial contamination (14%) and of physico-chemical problems with excess metals (30 %) in the water supplied to these buildings. Origins of these problems include defective disinfection, insufficient rinsing of new water systems, and persistent contaminations of specific installations, such as over-pressure systems and hot water tanks. Another problem which is occurring more and more frequently in new buildings is the presence of sediments composed primarily of mixtures of zinc (oxide and carbonate) and iron compounds. (Author's abstract)
W83-02844

TELECONTROL AND THE COMPUTER IN WATER SUPPLY (TELESURVEILLANCE ET ORDINATEUR AU SERVICE DES EAUX),
Societe Francaise de Distribution d'Eau (France).
A. Lepretre.
Techniques et Sciences Municipales, No 2, p 69-76, February, 1981. 3 Fig. (No English Summary).

Descriptors: *Water supply, *Automation, *Computers, Water conveyance, Water treatment facilities, Personnel, Telemetry, France, Remote sensing, Costs.

The Societe Francaise de Distribution d'Eau operates a public water supply service which is located for the most part in the Ile-de-France region. To best meet the system's need for constant control, the S.F.D.E. instituted a centralized telecontrol system at its drinking water facilities and then extended the system to include the sanitation service. A central computer located at Annet-sur-Marne, where S.F.D.E. operates a large plant treating water from the Marne River, controls the 250 pumping stations, reservoirs, and treatment plants through the use of a telephone system. Each of the facilities is equipped with a transmitter connected to the telephone system which keeps watch over several alarms. Whenever an alarm is activated, this information is forwarded by the transmitter to a computer located at Annet-sur-Marne. After identifying the affected points and alarms, the computer in turn forwards the alarms to on-call personnel, matching the geographical position of the affected facility to that of the personnel. This system has reduced personnel use to the strictly necessary, allowing for considerable savings. (Author's abstract)
W83-02846

THE ROLE OF DOC, UV ABSORPTION AND TOH MEASUREMENTS IN WATER POLLUTION CONTROL,
National Inst. for Water Research, Pretoria (South Africa).
For primary bibliographic entry see Field 5D.
W83-02882

VOLATILIZATION OF ORGANIC TRACE CONTAMINANTS BY AIR STRIPPING FOR WATER RECLAMATION,
Stanford Univ., CA. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W83-02917

A THEORETICAL AND EXPERIMENTAL INVESTIGATION OF THE DYNAMICS OF BREAKPOINT CHLORINATION IN DISPERSED FLOW REACTORS,
California Univ., Los Angeles. School of Engineering and Applied Science.
M. K. Stenstrom, and H. G. Tran.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-203414, Price codes: A08 in paper copy, A01 in microfiche. California Water Resources Center Completion Report, Univ. of California, Davis, April 1983. 155 p, 28 Fig, 17 Tab, 91 Ref, 1 Append. OWRT A-073-CAL(1).

Descriptors: *Chlorination, *Residual chlorine, Dispersed flow reactors, *Breakpoint chlorination, Mathematical models, Simulation analysis, Model studies, Dispersion, Hydrogen ion concentration, *Finite difference methods, *Wastewater treatment, Water treatment.

The dynamics of breakpoint chlorination were examined in three continuous dispersed flow reactors. The reactors were comprised of 1/2, 2 and 3 inch PVC pipe, which were 730, 41, and 23 feet long, respectively. Chlorination of ammonia at various chlorine to ammonia ratios were investigated over the pH range of 6.5 to 7.5. Seventeen experiments were performed in the three reactors over the course of the experimental investigations. Chlorine residuals, including free, monochloramine, dichloramine, and nitrogen trichloride and ammonia were analyzed simultaneously. To quantitatively characterize the breakpoint reactions, a mathematical model, consisting of eight simultaneous, quasi-linear, partial differentials equations was developed. The model was solved using an implicit finite difference technique. The reaction rate coefficients were treated as parameters, and were estimated using a search technique to minimize the sum of squares of the difference between the expected and measured values. The model can now be used to simulated continuous flow chlorination processes in order to develop process operating strategies to maximize or minimize any given experimental objective. (Snyder-California)
W83-02926

COLOUR AND TURBIDITY REMOVAL WITH REUSABLE MAGNETITE PARTICLES--IV. ALKALI ACTIVATED MAGNETITE--A NEW SOLID, REUSABLE COAGULANT-ADSORBENT,
Commonwealth Scientific and Industrial Research Organization, South Melbourne (Australia). Div. of Chemical Technology.
L. O. Kolarik.
Water Research, Vol 17, No 2, p 141-147, February, 1983. 5 Fig, 4 Tab, 9 Ref.

Descriptors: *Turbidity, *Coagulation, *Iron compounds, *Water treatment, Magnetite, Iron oxide, Color removal, Sedimentation, Flocculation, Alum, Polyelectrolytes.

Akali treated magnetite (Fe304) was effective in removing color and turbidity from river water during laboratory jar tests. The process consists of 4 steps: (1) brief premix of activated magnetite with water at pH 4-6, (2) addition of coagulant followed by further mixing, (3) sedimentation of flocs, (4) regeneration by magnetic separation and treatment with 0.1 M sodium hydroxide. The sedimentation rate of the magnetized particles was 10 times faster than in conventional alum flocculation. Turbidity removal increased with decreasing particle size. The optimum 10 ml per liter dose of magnetite added to raw water of 21 NTU turbidity produced turbidities (NTU) as follows: 17 with 15-50 micron particles, 14 with 6-15 micron particles, and 3 with 1-5 micron particles. Magnetite used in conjunction with alum or cationic polyelectrolytes improved the performance and reduced settling time of the coagulant mixture. (Cassar-FRC)
W83-02948

EFFECT OF SOLUTION CHEMISTRY ON COAGULATION WITH HYDROLYZED AL(III): SIGNIFICANCE OF SULFATE ION AND PH,
Syracuse Univ., NY. Dept. of Civil Engineering.
R. D. Letterman, and S. G. Vanderbrook.
Water Research, Vol 17, No 2, p 195-204, February, 1983. 12 Fig, 16 Ref.

Descriptors: *Chemical reactions, *Chemical coagulation, *Aluminum, Sulfates, Clay, Kaolin, Hydrogen ion concentration, Flocculation, Laboratory studies, Adsorption, *Water treatment, Chemistry of precipitation.

A laboratory study was conducted to investigate the effects of pH and the background sulfate ion concentration on the efficiency of flocculation of kaolin clay suspensions when aluminum salts are used. The results from these jar tests were used to develop a conceptual model which helps to explain the relative significance of these variables in the flocculation process. The conceptual model assumes that the adsorption of aluminum hydrolysis products on the clay particles determines the net surface charge of the particles and the total volume concentration of the suspension. The surface charge of the composite particles appears to be determined by the extent of the aluminum hydroxide precipitate coating and the surface charge of the component surfaces. Solution pH and specifically adsorbed anions, such as sulfate, were shown to have an important effect on the charge and amount of the adsorbed precipitate and hence on the net charge, volume concentration, and stability of the composite particles. (Carroll-FRC)
W83-02949

RATE CONSTANTS OF REACTIONS OF OZONE WITH ORGANIC AND INORGANIC COMPOUNDS IN WATER--I. NON-DISSOCIATING ORGANIC COMPOUNDS,
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschultz, Duebendorf (Switzerland).
J. Hoigne, and H. Bader.
Water Research, Vol 17, No 2, p 173-183, February, 1983. 8 Fig, 6 Tab, 43 Ref.

Descriptors: *Ozonation, *Chemical reactions, *Organic compounds, Oxidation, Water treatment, Solutes, Kinetics, *Wastewater treatment, Laboratory studies.

In many countries, ozone is widely used for the treatment of drinking water and/or for oxidation of specified compounds in industrial wastewaters. In order to evaluate the advantages and risks of ozonation processes, kinetic data are needed to predict what products will remain in the water after specified durations of ozone applications. This study involved the measurement of the direct reactions of molecular ozone with solutes which do not dissociate. Rate constants of reactions of ozone with these non-ionized solutes, including aliphatic alcohols, olefins, chlorosubstituted ethylenes, substituted benzenes, and carbohydrates, were determined from the absolute rates with which ozone reacted in the presence of various concentrations of these compounds in water. They were tested by comparison with the relative rates by which pairs of these solutes are transformed by ozone. Different experimental methods were developed to determine such rate constants ranging from .02 to 100,000 per molar-second. Interferences between the direct reactions of ozone and reactions due to its preliminary decomposition to secondary oxidants could be eliminated. The kinetics of all the reactions studied are first order with respect to ozone and solute concentration. The rate of constants of many types of organic compounds in water are of the same order of magnitude as in organic solvents, although substituted benzenes react in water about 100 times faster. Comparisons of the rate constants with chemical structures of the reacting groups show that all reactions of ozone are highly selective and electrophilic. (Carroll-FRC)
W83-02950

RATE CONSTANTS OF REACTIONS OF OZONE WITH ORGANIC AND INORGANIC COMPOUNDS IN WATER--II. DISSOCIATING ORGANIC COMPOUNDS,
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschultz, Duebendorf (Switzerland).
J. Hoigne, and H. Bader.
Water Research, Vol 17, No 2, p 185-194, February, 1983. 8 Fig, 3 Tab, 29 Ref.

Descriptors: *Ozonation, *Chemical reactions, *Organic componds, Oxidation, *Water treatment, Kinetics, Phenols, Amino acids, Hydrogen ion concentration, Laboratory studies, *Wastewater treatment, Industrial wastes.

In many countries, ozone is widey used for the treatment of drinking water and/or for oxidation of specified compounds in industrial wastewaters. In order to evaluate the advantages and risks of ozonation processes, kinetic data are needed to predict what products will remain in the water after specified durations of ozone applications. At the pH of biological systems or natural waters, the reaction rates observed for reactions of acidic and basic organic compounds are often regulated by the small fraction of deprotonated species present. This paper presents comprehensive lists of rate constants of reactions of ozone with such acidic and basic organic chemicals as amines, amino acids, carboxylic acids, and phenols dissolved in water. The second-order rate constants were found to increase with pH, as does the degree of deprotonation of the dissolved substances, for example, from 1 to 100 per molar-second for formic acid and from 0.2 to 2 per molar-second for glyoxalic acid. The kinetics of all the reactions studied were first order with respect to ozone and solute concentrations. The rate constants of many types of organic compounds in water are of the same order of magnitude as in organic solvents. The rate and selectivity of ozonation reactions are highly dependent on the pH of the water or solute. (Carroll-FRC)
W83-02951

THE HEALTH SIGNIFICANCE OF VIRUSES IN WATER.
Water Research, Vol 17, No 2, p 121-132, February, 1983. 161 Ref.

Descriptors: *Viruses, *Public health, *Water treatment, Fate of pollutants, Pollutant identification, Water pollution effects, Reviews, Water quality, Indicators, Epidemiology, Water reuse, Bacteria, Human diseases.

The virologic aspects of water quality were reviewed by a committee of 16 persons from 9 countries. Transmission of viral diseases by water has been proved by epidemological documentation for hepatitis, gastroenteritis, and adenovirus infections. In general, waterborne viral disease has been under-reported, especially in developing countries. The long incubation periods and sub-clinical symptoms of some diseases also contribute to the difficulties of gathering epidemiological evidence. The minimum human infectious dose (MIF) of virus has not been established. A few workers assume an MIF of 1 PFU; most evidence points to a higher value, which depends on age, state of health, diet, and immunity. Most of the study group did not feel that the low-level transmission hypothesis is realistic in estimating health risks of viruses in water. Treatment of water to meet coliform standards does not necessarily prevent outbreaks of viral diseases or giardiasis. Although viruses have been detected in swimming water which meets coliform standards, documentation of resulting disease is scarce. In edible shellfish no practical alternative to coliform specifications has been proposed. Even though levels of bacterial indicators are often not proportional to virus levels, many have been useful to monitor the virucidial effects of water treatment. These indicators include coliforms, standard plate count, acid-fast bacteria, Clostridium perfringens spores, coliphages, cyanobacteria, and other phages. Research needs in the field of waterborne viral disease are: improved monitoring systems, suitable quality limits, epidemiology and methods of transmission, and the use of purified wastewater in irrigation. (Cassar-FRC)
W83-02959

SANITARY MICROBIOLOGIC ASSESSMENT OF WATER DESALINATION BY DISTILLATION (SANITARNO-MIKROBIOLOGICHESKAYA OTSENKA DISTILLYATSIONNOGO METODA OPRESNENIYA VODY),
Institute of General and Municipal Hygiene, Moscow (USSR).
For primary bibliographic entry see Field 3A.
W83-03010

OBTAINING AN ANALYTICAL GRASP OF WATER DISTRIBUTION SYSTEMS,
Pitometer Associates, Columbia, MD.
M. Siedler.
Journal of the American Water Works Association, Vol 74, No 12, p 628-630, December, 1982. 1 Tab.

Descriptors: *Water distribution, *Planning, Systems analysis, Management, Water management, Water supply, Metering, Leakage, Valves, Hydrants, Maintenance.

Described are engineering studies that can be undertaken to address the dual problems of pipeline leakage and long range planning for improving distribution systems. An efficiently maintained system - one that is properly designed to meet phased needs - will save money and produce maximum revenue. Methods for locating leakage include listening surveys and flow rate measurements. Water audits are also useful; they locate not only leaks but also defective valves in the field, and defective hydrants are identified. Loss-of-head tests and fire hydrant flow tests also yield vital information. These studies and measurements must be correlated and used intelligently in designing improvements. In designing main feed lines, it is necessary to consider how the water can be brought to certain sections where it is needed without undue loss os head from friction, in sufficient quantities, and under all conditions of draft that are likely to occur. Computations can be made covering the period for which improvements are intended so that each stage can be completed by the time it is needed. A definite program results in an orderly procedure for construction of new work. A long range plan provides opportunities to take advantage of buying material under favorable markets. Once needs are analyzed, a program of improvements can be implemented in an orderly, efficient manner. (Baker-FRC)
W83-03066

DRINKING WATER AND LEGIONNAIRES' DISEASE,
Health Effects Research Lab., Cincinnati, OH.
A. P. Dufour, and W. Jakubowski.
Journal of the American Water Works Association, Vol 74, No 12, p 631-637, December, 1982. 4 Fig, 5 Tab, 52 Ref.

Descriptors: *Public health, *Drinking water, *Bacteria, Legionella pneumophila, Surface waters, Potable water, Water pollution control, Public health.

Up-to-date information is provided on control measures which can be used to combate legionellosis, the various forms of the disease, and methods of detecting the presence of the bacteria. Legionella pneumophila is a gram-negative, slow growing, rod-shaped bacterium that does not grow on ordinary laboratory media. Sources of legionella include surface waters, both pristine and contaminated, and potable waters. A summary of the number of outbreaks and cases of legionellosis associated with potable water that have occurred since 1979 is prepared. The outbreaks reported in the literature have been few in number. Most of the outbreaks have been linked to shower heads or water taps in hospital environments. Another group of legionellosis cases was associated epidemiologically with a hotel. Free chlorine has been found effective in controlling Legionella in potable water. Intermittent high temperature treatment in a hospital's hot water distribution system without chlorination also appeared to be an effective short-term means for controlling the level of Legionella. A number of the major outbreaks of legionellosis were associated with cooling towers and evaporative condensers, and a cumbersome, but relatively easy method was available for examining water samples. It is recommended that institutions with high-risk populations be made aware of the potential health hazards associated with legionella in finished water. (Baker-FRC)
W83-03067

COMPARATIVE INACTIVATION OF SIX ENTEROVIRUSES BY OZONE,
Grand Island Biological Co., NY.
D. Roy, R. S. Englebrecht, and E. S. K. Chian.
Journal of the American Water Works Association, Vol 74, No 12, p 660-664, December, 1982. 10 Fig, 2 Tab, 8 Ref.

Descriptors: *Public health, *Viruses, *Ozonation, *Drinking water, Water treatment, Disinfection, Enteroviruses, Poliovirus, Coxsackievirus, Echovirus.

A study was undertaken to determine the relative ozone resistance of six enteroviruses, two from each of the subgroups poliovirus, coxsackievirus, and echovirus. Inactivation by ozone was determined by using a continuous flow, completely mixed reactor under controlled laboratory conditions. Ozone was present at 0.15 mg/L at pH 7.2 and 20 degrees C. Tests showed a decreasing order of resistance as follows: poliovirus 2, echovirus 1, poliovirus 1, coxsackievirus B5, echovirus 5, and coxsackievirus A9. The resistance of poliovirus 2 was about forty times that of coxsackievirus A9. The resistance of two viral types within a given subgroup was also found to vary markedly. An increase in residual ozone concentration resulted in a decrease in resistance to inactivation. The temperature of the suspending medium or water was noted to affect viral inactivation by ozone. An increase in temperature resulted in a decrease in viral resistance when all other environmental conditions were constant. The effect of pH on viral resistance was investigated with two viral strains. The viruses were noted to be more resistant at lower acidic pH than at neutral pH. The resistance of poliovirus to inactivation by ozone at a residual concentration of 0.15 mg/L was about 4 times greater at pH 4.3 than at pH 7.2. (Baker-FRC)
W83-03068

RECENT DEVELOPMENTS IN WATER TREATMENT IN FRANCE,
Compagnie Generale des Eaux, Paris (France).
M. Rapinat.
Journal of the American Water Works Association, Vol 74, No 12, p 610-617, December, 1982. 13 Fig, 3 Tab, 70 Ref.

Descriptors: *Water treatment, *Drinking water, *Ozonation, Chlorination, Ozone, Chlorine, Trihalomethanes, Activated carbon, Paris, *France, Filtration, Taste, Water quality.

Source water near Paris, France, has deteriorated in recent years, causing a reevaluation of traditional chemical treatment of drinking water. Good results have been obtained by using natural biological purification in conjunction with activated carbon, thus reducing the amount of chemical reagents needed and also improving the taste of the water. Ozone is used before filtration, before activated carbon filtration, and after carbon filtration. The cost of these improved techniques is only about 6% more than that of traditional chemical reagent techniques. There is a greater homogeneity of treated water because the new treatment trains are less sensitive to fluctuations in raw water quality than are the traditional processes that depend on chemical elimination of pollutants. There was as much as a 15% increase in the removal of organics, and the extent of purification compared with raw water has increased to 80%. There is lower bacterial growth in the treated water and therefore a reduction in the amount of residual chlorine needed for protecting the distribution system. There is a marked improvement in the taste of the water, resulting from the disappearance of combined chlorine and an inprovement in micropollutant removal. There is also a clear reduction in the trihalomethane content of the distributed water. (Baker-FRC)
W83-03069

BUILDING WATER AND SANITATION PROJECTS IN RURAL GUATEMALA,
Hazen and Sawyer, Miami, FL.
A. W. Karp, and S. B. Cox.
Journal of the American Water Works Association, Vol 74, No 4, p 163-169, April, 1982. 1 Fig, 1 Tab, 3 Ref.

Descriptors: *Water supply, *Rural areas, *Training, Water resources development, *Guatemala,

Developing countries, Agua del Pueblo, Sanitation, Drinking water, Springs, Planning, Water distribution, Financing.

The Agua del Pueblo, a private, nonprofit technical assistance organization, has been promoting water and sanitation services in rural Guatemala since 1972. First, a technology appropriate for the individual village is chosen, with consideration of minimizing construction and operating costs and maximizing use of local labor and construction materials. It is desirable to find a water source which does not require treatment or use of expensive forms of energy. In highland Guatemala gravity flow systems and hydraulic rams have been widely developed. Hand pumping of groundwater is less feasible because water tables are at a depth of 30-60 m. Complementary activities include latrine construction, health and hygiene education, and reforestation of the watershed above the spring. An essential part of the program is training of village personnel for routine maintenance and of paraprofessional technicians for bridging the gap between civil engineers and the native population. After graduating from the 35-hour per week, 6-month training course, technicians are capable of planning, design, and construction of village water projects. Self-financing techniques for construction and maintenance has been successful. A water project involves community participation at all stages: initial promotion, feasibility studies, legal arrangements, planning, census and mapping, surveying, final design and budget preparation, and construction. (Cassar-FRC)
W83-03071

TOXICOLOGICAL PROBLEMS ASSOCIATED WITH ALTERNATIVE METHODS OF DISINFECTION,
Health Effects Research Lab., Cincinnati, OH.
For primary bibliographic entry see Field 5C.
W83-03087

THE ROLE OF FILTRATION IN PREVENTING WATERBORNE DISEASE,
Environmental Protection Agency, Cincinnati, OH. Drinking Water Research Div.
G. S. Logsdon, and E. C. Lippy.
Journal of the American Water Works Association, Vol 74, No 12, p 649-655, December, 1982. 10 Fig, 3 Tab, 26 Ref.

Descriptors: *Human disease, *Filtration, *Drinking water, *Water treatment, Public health, Microorganisms, Giardiasis, Chlorine, Chlorination, Bacteria, Review, History, Filters, Turbidity, Disinfection, Water pollution sources.

Pilot plant data and results from full scale operation are presented to illustrate the effectiveness of various forms of filtration in reducing microbial populations to concentrations that are easily controlled by disinfection. A review of old as well as new literature shows that slow sand filters, rapid granular media filters, and DE filters are capable of removing bacteria, viruses, and cysts if designed and operated properly. Each of these filtration processes can be rendered ineffective by faulty design or by careless or improper operation. At slow sand filtration plants, controlling filtration rates and filtering to waste after filters are scraped are important aspects of filter operation. Effective coagulation and control of the filtered water's turbidity at rapid rate filter plants will do much to assure that filtered water has a minimum number of microorganisms. The operator can control turbidity of the water more precisely by monitoring turbidity at each filter rather than at the clearwell. The particle size of diatomaceous earth (DE) selected for precoat and body feed influences removal of bacteria by DE filters. In order to remove viruses most efficiently by means of DE filtration, of some modification of either the filter aid or the raw water is needed. Raw water can be modified using cationic polymer. DE filtration is effective for removing cysts if an adequate precoat is used and the septum is kept very clean. (Baker-FRC)
W83-03088

A MODEL OF COSTS FOR TREATING DRINKING WATER,
Municipal Environmental Research Lab., Cincinnati, OH.
R. M. Clark, and P. Dorsey.
Journal of the American Water Works Association, Vol 74, No 12, p 618-627, December, 1982. 6 Fig, 14 Tab, 9 Ref.

Descriptors: *Drinking water, *Water treatment, *Cost analysis, Mathematical equations, Design criteria, Legislation, Maintenance.

The Safe Drinking Water Act of 1974 emphasizes the need to consider costs when promulgating regulations. In response to the concerns about the costs of technological requirements, research was undertaken to develop cost data associated with 99 unit processes for treating drinking water. These estimates were then used as a basis for regression analysis estimates calculated on equations derived for operations and maintenance costs and capital costs annualized at 8% over a 20 year amortization period. The equations and some typical applications of them are reported. Predesign estimates can be used to compare the cost of two treatment plants with similar water treatment goals and to choose the most cost-effective treatment alternative. A series of cost equations for conventional water treatment unit processes were developed that are accurate to approximately three significant figures. (Baker-FRC)
W83-03089

COSTS FOR SUPPLYING ALTERNATIVE COMMUNITY WATER AND SANITATION SYSTEMS IN BRAZIL,
For primary bibliographic entry see Field 6C.
W83-03092

MICROBIAL QUALITY OF WATER IN OLD WELLS AND THE PUBLIC WATER DISTRIBUTION SYSTEM IN THE U. S. VIRGIN ISLANDS,
Caribbean Research Inst., St. Thomas, VI.
H. Winters, and I. Isquith.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-208587, Price codes: A02 in paper copy, A01 in microfiche. Technical Report No 8, October 1981. 16 p, 8 Tab, 3 Ref. OWRT A-015-VI(1), 14-34-0001-1150.

Descriptors: *Cisterns, *Water harvesting, *Shallow wells, *Virgin Islands, Water wells, Drinking water, Domestic water supply, Microbial analysis, Public health, Coliforms, Streptococcus, Salmonella.

The Virgin Islands public water supply must meet the published standards in the provisions of the Safe Drinking Water Act (Public Law 93-523). The objective of this study was to determine whether there exists a potential health hazard to users of the Virgin Islands public water supply and old water wells. These old wells which were built in the early 1900's could serve as an alternate water source in watershort areas. Coliform bacteria were used as the reference indicator for bacteriological quality. The presence of fecal streptococcus and Salmonella spp. was ascertained as potential indicators of water quality. The public water distribution system and old wells did not generally meet the microbiological standards set forth in the Safe Drinking Water Act. Fecal streptococcus and Salmonella spp. were excellent indicator organisms of fecal pollution. A potential health hazard is believed to be associated with the public water distribution system in St. Croix and St. Thomas.
W83-03098

MICROBIAL ANALYSIS OF DOMESTIC CISTERN WATER IN THE U. S. VIRGIN ISLANDS,
Caribbean Research Inst., St. Thomas, VI.
H. Winters, and I. Isquith.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-208595, Price codes: A03 in paper copy, A01 in microfiche. Technical Report No 7, January 1981. 19 p, 9 Tab, 2 Ref. OWRT A-014-VI(1), 14-34-0001-0150.

Descriptors: *Cisterns, *Water harvesting, Water storage, *Virgin Islands, Microbial analysis, Public health, Heterotrophic bacteria, Algae, Protozoa, Drinking water, Coliforms, Salmonella, Streptococcus, Potable water.

A significant proportion of the water supply in the U.S. Virgin Islands comes from the rainfall which is stored in cisterns. Since cistern water is not part of the public distribution system, it is not covered by the Safe Drinking Water Act (Public Law 93-523). The objective of this study was to determine whether cistern water supplies pose a potential health hazard to their users. The cistern water supplies were studied to assess the types of heterotrophic bacteria, algae, and protozoa that may be present. The bacterial study was directed towards identifying those organisms capable of causing disease in water supplies. Total coliform, fecal streptococcus and Salmonella sp. were enumerated. The presence of coliform bacteria, fecal streptococcus and Salmonella sp. in most of the cistern water supplies suggested a potential health problem. Algae and protozoa were found in several cistern waters, which indicated a high level of microbial diversity. These complex ecosystems suggested a continuous input of carbon and energy sources into the cisterns. The pollution of these cistern water supplies seemed to be of extreme significance, which has been overlooked by those involved in ascertaining the microbial quality of all drinking water in the U.S. Virgin Islands.
W83-03099

CHARACTERIZATION AND TREATABILITY OF THE BY-PRODUCTS OF CHLORINATION OF NATURALLY OCCURRING HUMIC SUBSTANCES,
Massachusetts Univ., Amherst. Water Resources Research Center.
F. A. DiGiano, P. C. Uden, W. C. Saracen, and E. L. Coker.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-208868. Price codes: A06 in paper copy, A01 in microfiche. Publication No 134, December 1982. 102 p, 34 Fig, 21 Tab, 27 Ref, 2 Append. OWRT A-117-MASS(1), 14-34-0001-0123.

Descriptors: *Chlorine, *Chlorinated hydrocarbons, *Chlorination, *Humic acids, *Halogens, Fulvic acids, Chemical analysis, Chemical properties, Chemical reactions, Adsorption, Molecular structure, Massachusetts, Wastewater treatment, Water treatment.

One method for meeting the new USEPA regulation controlling trihalomethane (THM) conentration is to remove the naturally occuring humic substances which react with chlorine to form THM's. In this research, humic substances obtained from three widely separated sites in, respectively, Amherst, Lee, and Middleton, Massachusetts were characterized as to their potential to form THM's, and, in the case of Amherst and Lee samples, as to their adsorbability on activated carbon. The similarity in THM production of fulvic acids from the same source suggested a relationship between drainage area and water chemistry. However, little difference was also found from source to source, implying that the reaction with chlorine is not very dependent on the structural characteristics of the humic substances. Only the lowest molecular fractions of humic substances were adsorbable to any extent. Mathematical analysis was used to show that unfavorable isotherms can result from competitive adsorption among components in a mixture. Treatment to remove THM precursors should include consideration of both reactivity toward chlorine and adsorbability of various molecular weight fractions in the mixture. In this study, the higher molecular weight fractions produced the most THM but were the least adsorbable. Therefore, these fractions should be targeted for removal by coagulation.
W83-03106

5G. Water Quality Control

THE SUCCESSES OF INCREASED WASTEWATER TREATMENT PLANT CON-

STRUCTION ON THE RHINE (ERFOLGE VERSTARKTEN KLARANLAGENBAUS AM RHEIN),
K. G. Malle.
Wasser, Luft und Betrieb, Vol 26, No 7/8, p 12, July/August 1982. 1 Tab, 3 Ref. (No English Summary).

Descriptors: *Wastewater treatment facilities, *Water pollution control, *Water pollution prevention, *Wastewater treatment facilities, Rivers, Rhine river, *Federal Republic of Germany, Water quality control, Pulp and paper industry, Organic compounds, Dissolved solids, Humic acids, Chlorides, Halogens, Chlorine, Drinking water, Hydrocarbons.

The Working Committee of Rhine Waterworks stated in its 1981 annual report that the total pollution loading of the Rhine river with dissolved organic matter had decreased by 50% since 1974. Oxygen content and ammonium concentration had also improved. This phenomenon was more apparent in the lower Rhine than in previous years and was achieved through the construction of wastewater treatment plants and changes in production procedures in the paper industry, resulting in a reduced discharge of lignosulfonic acids. Heavy metal pollution has ceased to be a problem for waterworks on the banks of the river. Between 1973 and 1981, dissolved organic carbon content decreased by approximately 550 tons/day (130 tons/day of this in lignosulfonic acids) and humic acids increased by about 260 tons/day. Hydrocarbon content did not change appreciably. Miscellaneous organic substances were reduced from approximately 430 to approximately 90 tons/day. In 1982, 70% of organic pollution consisted of humic acids, and future studies should concentrate on these. Organochlorine compounds decreased greatly after 1973, but have been at an almost constant level for the last few years; they consist mainly of larger organic molecules with a low chlorine content, such as chlorolignin. A research program undertaken by large chemical companies in the Rhine catchment area together with the Federal Ministry for Research and Technology is studying which substances in which industrial wastewaters are difficult to remove by drinking water treatment. Chloride content is still problematic for waterworks, particularly because of fluctuations in concentration. France's recent promise to stop discharge of at least 20 kg/sec of chloride should provide some improvement. (Gish-FRC)
W83-02802

WATER AND AIR RENEWAL IN RESERVOIRS (LES RESERVOIRS D'EAU POTABLE. 1-LE RENOUVELLEMENT METHODIQUE DE L'EAU ET DE L'AIR DANS LES RESERVOIRS),
Compagnie Generale des Eaux, Paris (France).
J. Fontaine.
Techniques et Sciences Municipales, No 3, p 151-158, March 1981. 11 Fig, 2 Ref. (No English Summary).

Descriptors: *Storage reservoirs, *Water quality control, *Aeration, *Filtration, Simulation analysis.

Maintenance of water quality in storage reservoirs necessitates methodical renewal of the stored water. A reduced model was used in a systematic study designed to determine the location of inlet and outlet branches in reservoirs which would ensure proper blending of the stored water. Various conventional reservoir shapes were tested. Studies with blowers resulted in the development of an air renewal and filtration system which has been implemented on a 45,000 cubic meter reservoir. Operational data from this application resulted in improvement of the use of the equipment, making the system both reliable and operable at only modest expense. The equipment significantly reduces the number of bacteria in the air coming into contact with stored water in large reservoirs. (Carroll-FRC)
W83-02815

LAKE ERIE OXYGEN DEPLETION CONTROVERSY,
Canada Centre for Inland Waters, Burlington (Ontario).
J. Barica.
Journal of Great Lakes Research, Vol 8, No 4, p 719-722, 1982. 1 Fig, 5 Ref.

Descriptors: *Oxygen depletion, *Phosphorus, *Lakes, Hypolimnion,, Water quality control, *Lake Erie, Anaerobic conditions, Pollution load, Trophic state, Eutrophication.

A workshop on the response of Lake Erie hypolimnetic anoxia to phosphorus controls held at the Canada Center for Inland Waters, Burlington, Ontario, December 2-3, 1981, confirmed the desirability of reducing P in the lake and validated the feasibility of the 1978 Great Lakes Water Quality Agreement's goal of restoring aerobic conditions to bottom waters of the central basin on a year-round basis. No revisions in the present strategy were recommended. It was agreed that oxygen conditions in the lake are related to degree of P input control, but there were differences of opinion regarding the degree of response. The unpredictability of natural processes makes it difficult to accurately predict future hypolimnetic oxygen conditions. Some conclusions reached in the 12 presentations were: temporary anoxia could occur in localized areas in years of unfavorable meteorological conditions, oxygen conditions have generally improved during 1978-80, and late summer oxygen conditions are likely to improve. Several authors claimed that decreases in P loading would have minimal effect on oxygen conditions because oxygen depletion rates are affected by physical factors such as the ratio of lake volume to sediment area, thickness and temperature of the hypolimnion, and trophic state. (Cassar-FRC)
W83-02824

DEFINING COST-EFFECTIVE SALINITY CONTROL PROGRAMS,
Agricultural Research Service, Prosser, WA. Irrigated Agriculture Research and Extension Center.
R. G. Evans, W. R. Walker, and G. V. Skogerboe.
Journal of the Irrigation and Drainage Division, Proceedings of the American Society of Civil Engineers, Vol 108, No 4, p 265-272, December, 1982. 4 Fig, 1 Tab, 11 Ref.

Descriptors: *Salinity, *Cost analysis, *Colorado River Basin, Imperial Dam, Water quality control. *Salinity control, Arizona.

The optimal salinity control program involving PL 93-320 projects in the Upper Colorado River Basin would cost about $30 million annually and prevent about 1.2 million metric tons of salt per year from entering the Colorado River System. These figures were derived from a comparison of the annual costs of salinity control in the Upper Basin with annual salinity related damages in the Lower Basin. The goal of removing 2-3 million metric tons of salt per year from flows passing into the Lower Basin cannot be achieved cost effectively with the proposed salinity control projects. Without any salinity control measures the probable maximum salt concentration at Imperial Dam is 1210 mg per liter. It is cost effective to control salinity only up to about 1030 mg per liter. Therefore, it would be necessary to allow the salinity levels at Imperial Dam to rise by as much as 180 mg per liter to balance control costs with downstream damages. (Cassar-FRC)
W83-02829

EFFECTIVENESS OF TREATMENT TO MEET PHOSPHORUS OBJECTIVES IN THE GREAT LAKES,
Texas A and M Univ., College Station. Dept. of Civil Engineering.
S. C. Chapra, H. D. Wicke, and T. M. Heidtke.
Journal of the Water Pollution Control Federation, Vol 55, No 1, p 81-91, January, 1983. 3 Fig, 12 Tab, 17 Ref.

Descriptors: *Phosphorus, *Lake restoration, *Cost analysis, Water quality control, *Great Lakes, Eutrophic lakes, Model studies, Optimization, Water pollution sources, Nonpoint pollution sources, Urban runoff, Storm wastewater, Economic evaluation.

A least cost phosphorus control program for the Great Lakes, capable of achieving water quality objectives, was calculated using mathematical models, optimization techniques, and economic information. The system was considered as 11 interconnected segments, each with individual total P objectives. The least cost strategy relies on a mixture of point source and diffuse source controls and on zoned, rather than uniform, treatment. The optimal degree of treatment varies widely among the 11 basins. Total annual costs for the optimum strategy are $378 million ($187 million for point source control, $31 million for rural runoff control, and $160 million for urban runoff control). The rate of treatment costs accelerates rapidly with increasingly stringent water quality objectives. About 83% of the objectives could be achieved for about 23% of the total cost of the optimal treatment program. (Cassar-FRC)
W83-02830

THE USE OF WATER QUALITY MODELS IN MANAGEMENT DECISION MAKING,
Environmental Research Lab., Athens, GA.
T. O. Barnwell, Jr, and P. A. Krenkel.
Water Science and Technology, Vol 14, No 9-11, p 1095-1107, 1982. 6 Fig, 21 Ref.

Descriptors: *Model studies, *Decision making, *Water management, *Water quality control, Planning, Mathematical models, Management decisions, Pesticides, Hazardous wastes, Water quality.

The use of water quality models in three management contexts is described: screening, planning and design. Screening models are illustrated by describing a methodology applicable to large areas of land and another applied to a large number of chemicals. The application of models in a planning context is illustrated by a local planning agency's use in developing nonpoint source control strategies and by the federal government's use in assessing potential exposure to a pesticide. Development of design criteria is illustrated by summarizing the long history of model use to develop effluent limits in the Holston River basin in Tennessee. Experience has shown that wherever possible model results should be confirmed with independent data or analyses. A thorough and objective review of a model application can be significant factor in the acceptance of a model's results, both in the specific application being considered and in future applications of similar models. (Baker-FRC)
W83-02847

REMOVAL OF PESTICIDES AND HERBICIDES BY MEANS OF ADSORPTION ON ACTIVATED CARBON,
Chemviron S.A., Brussels (Belgium).
D. V. Heroes.
Water Science and Technology, Vol 14, No 9-11, p 1527-1532, 1982. 4 Fig, 3 Tab.

Descriptors: *Organic compounds, *Leaching, *Soil contamination, *Groundwater contamination, Herbicides, Pesticides, Filtration, Activated carbon, Purification, Sweden.

Drums containing toxic liquid herbicide and pesticide waste were buried at Techmatorp, Sweden. The material leaked into the ground, resulting in soil contamination over an area of about 100,000 sq m. For treatment, a plan was developed to inject water into the contaminated soil and collect it in a storage reservoir. The collected wastewater would then be purified by granular activated carbon and recycled for reinjection. The actual installation consists of multi-media prefilters, two adsorbers working in series, and a transfer vessel containing activated carbon, allowing the exchange of an exhausted load for a reactivated one using only one tanker. Upon saturation the activated carbon is thermally reactivated. The adsorbed organics are incinerated and the adsorption capacity of the activated carbon is restored, allowing re-use of the carbon. The soil decontamination system works in closed circuit. The treated water is re-injected into the contaminated soil, and after percolation, is collected in a storage tank from where it is pumped back into the treatment unit. When heavy rainfall occurs, water injection is not needed. The

treated water is discharged to a nearby sewage works. The phenoxy acid concentration in the washing groundwater decreased by a factor of 100 during the three years of treatment. (Baker-FRC)
W83-02857

APPLICATION TO ESTUARINE AND COASTAL WATERS,
Water Research Centre, Stevenage (England).
For primary bibliographic entry see Field 5B.
W83-02865

APPLICATION TO RIVERS AND UNDERGROUND WATERS,
Brussels Univ. (Belgium). Lab. of Hydrology.
J. L. Marivoet, F. De Smedt, A. Van der Beken, J. Dirickx, and W. Van Craenenbroeck.
Water Science and Technology, Vol 14, No 9-11, p 1073-1094, 1982. 5 Fig, 113 Ref.

Descriptors: *Model studies, *Water management, *Water quality control, Groundwater management, Rivers, Mathematical models, Planning, Policy making.

Mathematical models are described for determining water quality in rivers and groundwaters derived from the mass balances. For rivers a one dimensional transport equation is derived. Different methods of parameter estimation are considered, and more recent techniques are introduced. For the application of water quality models to river management two groups of models are considered. These are the simulation models and the optimization models. The Bedfore-Ouse quality models represent one application. Practical and theoretical applications have been made in England, Germany, the United States and Belgium. For groundwaters, several applications of water quality transport models are discussed, and the use in groundwater management is considered. The various models presented range from simple mass balance models to very complex sets of non-linear partial differential equations with time variant parameters and from simulation models to optimization models. Progress in water quality monitoring will permit the application of real-time water quality models, which can be of great help for short term management of water intake points and can help to avoid short but serious degradations of the water quality. (Baker-FRC)
W83-02866

LEGAL AND ADMINISTRATIVE CONTROL ASPECTS OF OIL POLLUTION,
Department of Energy, London (England). Petroleum Engineering Div.
A. D. Read.
Water Science and Technology, Vol 14, No 9-11, p 133-1157, 1982. 1 Fig, 3 Tab, 13 Ref.

Descriptors: *Water pollution control, *Legal aspects, *Administration, Decision making, Oil spills, Water pollution sources, Oil, Refineries, Industrial wastes.

The nature of the releases of oil to marine and fresh water environments that can occur during the production, transportation and refining of crude oil and from the distribution, use and ultimate disposal of its products are considered. The primary concern historically has been with persistent oils because of the visible contamination of the sea, especially inshore waters, and of beaches by oil spilled on them or reaching them from a spillage further out at sea. International Law as it relates to the control of oil pollution on a global and regional basis is considered, with particular stress on international customary law. Oil reaches marine and fresh water environments through natural releases, operational discharges, non-point sources and accidents. Various pollution prevention controls are noted, along with the role of national government and regional convention in the enforcement of pollution control measures. Pollution from dumping operations, refineries, ballast and slops reception facilities and other industrial and municipal waste discharges is examined. Mutual assistance efforts in responding to oil spill incidents are outlined. (Baker-FRC)
W83-02868

THEME 5: WATER POLLUTION CONTROL IN DEVELOPING COUNTRIES: REPORT OF THE SESSION CONVENOR,
Toronto Univ. (Ontario). Dept. of Civil Engineering.
For primary bibliographic entry see Field 6F.
W83-02873

LEGAL AND ADMINISTRATIVE ASPECTS,
National Swedish Environment Protection Board, Solna.
L. Brynoff, and B. Hawerman.
Water Science and Technology, Vol 14, No 9-11, p 1319-1934, 1982.

Descriptors: *Legal aspects, *Administration, *Developing countries, Water management, Policy making, Political aspects, Botswana.

The need for sound legislation and competent administration in order to achieve successful water management are discussed. Two case studies are presented, one from the Botswana Meat Commission at Lobatse which includes an abattoir and a cannery with a tannery attached as a separate unit, and the second in Molepolole, a major village of Botswana where a hospital, schools and government buildings are serviced by a new sewerage system. It is inferred from these cases that operational water pollution control must be based on certain important elements. For instance, there must be pollution control legislation based on a general consensus in these matters. There must be administrative authorities to provide for the needed expertise and law enforcement. There must be laid down recognized procedures for the handling of matters in various situations. It is noted that the situation varies from country to country and solutions to water pollution control problems must be tailored to suit the actual situation. It follows that while many of the points made are taken for granted in some countries, there is still a long way to go in other countries in organizing operational water pollution control. (Baker-FRC)
W83-02874

WATER POLLUTION CONTROL IN DEVELOPING AREAS - TRAINING AND EDUCATION,
Technische Hochschule, Aachen (Germany, F.R.). Inst. fuer Wasserbau.
K. Poppinghaus.
Water Science and Technology, Vol 14, No 9-11, p 1325-1335, 1982. 5 Tab, 9 Ref.

Descriptors: *Water pollution control, *Wastewater treatment, *Developing countries, Education, Training, Management, Water management.

Experience in developing the threshold countries has demonstrated that training and further education in natural sciences and engineering have preeminent and decisive importance. Training, further education and instruction in the area of water pollution control should be considered as a central point in every policy of aid for development. Training and further education must be carried out at university, specialized school and trade school sectors in order to achieve a hierarchically structured training and personnel that have been expertly trained in all areas. Specialized schools should train staff for practical related planning and decision-making employment in sewage and water works, because usually for using soft technology in water pollution control there is no need of highly sophisticated, trained staff from universities. A long term strategy for establishing this training scheme in developing countries guarantees only that the conditions in water quality and sanitation management can be retained and further developed. These long term and expensive measures of training in the developing country itself do not, however, cover the current need for well trained personnel. A number of suggestions of measures which have been established in the general field of education are cited. Two major areas of activity in a communication and health/hygiene education program are the coordination of the staff and community auxiliary guidance material, manual, visual aids and teaching aids, and the organization at all levels and through all appropriate channels of health and hygiene education. Programs for the operation and maintenance of the water supply and sanitation systems in the developing world are cited. (Baker-FRC)
W83-02875

WATER POLLUTION CONTROL IN DEVELOPING AREAS: PROBLEMS AND NEEDS,
J. R. Simpson.
Water Science and Technology, Vol 14, No 9-11, p 1353-1373, 1982. 10 Fig, 1 Tab, 17 Ref.

Descriptors: *Water pollution control, *Developing countries, *Wastewater treatment, Planning, Education, Training, Water management, Water quality, Water supply.

The wholesomeness of water supplies is essential for the control of many water-related diseases in developing countries. Proper handling of wastes is an essential part of good water pollution control programs. High kills of pathogens can be achieved during storage in batch composing latrines, aerobic composting windrows and waste stabilization lagoons. While waterborne sewage systems are highly convenient and quickly remove wastes from the immediate environment, these are expensive, and sewage treatment is required before final disposal can be made. Satisfactory on-site and off-site excreta handling systems do exist, some of which can be adapted progressively as water service levels increase. Proper training is needed for operators and technicians, the maintenance of plant and the early control of industrial wastes. Pollution control procedures should only be adopted after assessing all local circumstances together with the historical experiences of other areas. Serious problems can arise when rural areas are developed into urban conurbations. These problems can be reduced if taken into consideration at the initial planning stages. Whenever possible the use of mechanical and electrical equipment should be avoided. Legislation to control industrial wastes should be available before any problems develop in that area.(Baker-FEC)
W83-02876

MINERALIZATION PROBLEMS IN THE PWV COMPLEX - THE IDENTIFICATION OF VIABLE SOLUTIONS BY MEANS OF A SUITE OF MATHEMATICAL MODELS,
Steward, Sviridov and Oliver, Johannesburg (South Africa).
C. E. Herold.
Water Science and Technology, Vol 14, No 9-11, p 1525-1526, 1982.

Descriptors: *Minerals, *Model studies, *Water quality, *South Africa, Flushing, Runoff, *Water pollution sources, Pretoria, Witwatersrand, Economic aspects, Salts, *Salinity control.

Mineral pollutant loads have risen to intolerable levels in the water in the Pretoria-Witwatersrand-Vereeniging (PWV) complex. With the onset of the rainy season there is a pronounced first flush phenomenon, whereby salts accumulated in the catchment are washed off. The problem is compounded by the feedback effect, whereby effluents are recycled into the supply, with consequent build-up of salinity. Without some form of numerical model it is not possible to plan measures to improve the position. A suite of models was developed using meteorological data as the basic input. These models simulate at key points in the system, for any demand horizon, the monthly or daily salt concentrations associated with a wide variety of alternative management strategies. Incorporated into the models are the economic parameters relating salinity in the water supply to the costs incurred by consumers who have to use water of poor quality. A method has been evolved whereby the costs and benefits to consumers resulting from various water resources and pollution control planning and management options can be objectively compared. It was determined that within the PWV region the flow weighted average increase in TDS concentration during one usage cycle is 500 mg/liter; more than half of the TDS load originating in the southern PWV region is derived from diffuse

sources attributable to human activities; the storage of salts in the soil moisture zone and their transport via interflow play a significant role in the routing of diffuse source mineral pollutants through a catchment; and a strong correlation has been found between industrial water demand and the rate at which diffuse source salts are generated. (Baker-FRC)
W83-02881

EFFECTS OF WATER EXCHANGE ON WATER QUALITY IN CHANNEL CATFISH PONDS,
Auburn Univ., AL. Dept. of Fisheries and Allied Aquacultures.
C. E. Boyd.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-196493, Price codes: A02 in paper copy, A01 in microfiche. Water Resources Research Institute Completion Report, Auburn Univ. Ala. March 1983. 9 p, 1 Fig, 2 Ref. OWRT A-083-ALA(1), 14-34-0001-2101.

Descriptors: *Aquaculture, *Water quality control, Water use, Nutrient removal, *Catfish ponds, Channel catfish.

Nutrient and organic matter removal from catfish ponds by water exchange or biological extraction was investigated. Separate trials were conducted to determine losses of added phosphours, nitrate, nitrite, ammonia, and chemical oxygen demand. Chloride was added to ponds as an inert tracer to estimate the efficiency of water exchange. In spring (March - April), average water temperature and plankton biomass were low (15.1C and 10 ug/1 chlorophyll a), and water exchange at 134 m super 3/hour per hectare for 72 hours removed concentrations faster than in situ biological processes. In summer average water temperature and plankton biomass were high (29.5C and 101 ug/1 chlorophyll a), and biological extraction of nutrients and organic matter was equally as effective as water exchange in reducing concentrations. Water exchange at 134 super 3 hour per hectare was inefficient in reducing phytoplankton densities in ponds during the summer months because of regrowth of plankton community. Water exchange as practiced cannot be recommended as a water quality management technique in channel catfish ponds during the summer months.
W83-02897

PROBLEMS, ISSUES, CONSTRAINTS, AND BARRIERS TO WATER QUALITY PLANNING AND MANAGEMENT IN URBAN AND URBANIZING AREAS (SMSA'S) IN TENNESSEE,
Tennessee Univ., Knoxville. Graduate School of Planning.
For primary bibliographic entry see Field 6B.
W83-02899

THE INFLUENCE OF WATER EXCHANGE ON WATER QUALITY AND FISH PRODUCTION IN CHANNEL CATFISH PONDS,
Auburn Univ., AL.
M. V. McGee.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-196675, Price codes: A04 in paper copy, A01 in microfiche. Ph.D Thesis, March 1983. 50 p, 10 Fig, 11 Tab, 27 Ref. 3 Append. OWRT A-083-ALA(2), 14-34-0001-2101.

Descriptors: *Catfish farming, *Catfish ponds, Catfish, *Water exchange, *Water quality control, Water quality data, Water quality management, Channel catfish, Fish reproduction.

Water exchanges totaling 0, 1, 2, or 4 pond volumes were applied at 2 week intervals for 14 weeks (July - September) to 0.04 hectare ponds stocked with 10,625 channel catfish per hectare and fed up to 65.5 kg/hectare per day. Water samples taken 48 hours following water exchange indicated that levels of chlorophyll a (Chl a), chemical oxygen demand (COD), total ammonia nitrogen (TAN), and nitrite (NOsub 2-N) were not different (P >0.05) between treatments. Secchi disc visibilities were not greater (P>0.05) within treatments following exchanges. Fish production was not improved (P>0.05) by water exchange. Biological processes which also contributed to nutrient and COD removal in ponds masked effects of water exchange. Water budgets calculated for the ponds indicated an average of 85.5 cm of water was required to maintain water levels in ponds independent of water exchange during a 5 month period(May - September).
W83-02905

COMBINED WATER-FERTILIZER MANAGEMENT TO MINIMIZE NON-POINT WATER POLLUTION WHILE ACHIEVING HIGH CROP PRODUCTION,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
For primary bibliographic entry see Field 2I.
W83-02907

POLLUTION POTENTIAL RANKING OF BARNYARDS FOR PRIORITY WATERSHED PLANNING,
Wisconsin Univ.-Madison. Dept. of Soil Science.
T. C. Daniel, and R. M. Motschall.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-202358, Price codes: A02 in paper copy, A01 in microfiche. Water Resources Center Technical Report WIS WRC 83-02, Univ. of Wisconsin, Madison, 1983. 15 p, 4 Fig, 2 Tab, 14 Ref. OWRT A-093-WIS(1), 14-34-0001-0153

Descriptors: *Animal wastes, *Barn wastes, *Manure, *Water pollution prevention, *Watershed management, Agricultural watersheds, Dairy industry, Farms, Feedlot runoff, Feedlot wastes, *Phosphorus.

A barnyard ranking method using adjusted available P concentrations was developed so that pollution control funds can be allocated according to the 'worst first' approach. The ranking method was derived from soil data that was obtained from waterways and background locations near impact areas. Mean waterway available P concentrations ranged from 41 to 470 ppm. A distinct nutrient grandient exists in waterway soil with distance from barnyards so data obtained near the impact area are representative of waterway trends. Mean background available P concentrations ranged from 66 to 140 ppm. Background data indicate that excessive landspreading of manure occurred near barnyards. A critical management level (CML) was defined from background data collected near impact areas. The CML is a standard to establish a cutoff level between critical and noncritical sites. The proposed CML (150 ppm) is the best estimate based on available data.
W83-02915

HYDROLOGICAL AND ENVIRONMENTAL CONTROLS ON WATER MANAGEMENT IN SEMIARID URBAN AREAS -- PHASE II,
Arizona Water Resources Research Center, Tucson.
For primary bibliographic entry see Field 4D.
W83-02918

PRELIMINARY PROJECTIONS OF THE EFFECTS OF CHLORIDE-CONTROL STRUCTURES ON THE QUATERNARY AQUIFER AT GREAT SALT PLAINS, OKLAHOMA,
Geological Survey, Oklahoma City, OK. Water Resources Div.
J. E. Reed.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-151431, Price codes: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-120, 1982. 45 p, 8 Fig, 11 Tab, 25 Ref.

Descriptors: *Computer models, *Water quality, *Saline lakes, *Surface-groundwater relations, Aquifers, Brines, Groundwater movement, Solute transport, Geohydrology, Data collections, Model studies, Projections, *Oklahoma, Great Salt Plains.

About 1,200 tons of chloride per day are added to the salt load of the Salt Fork of the Arkansas River at Great Salt Plains Lake from natural sources. The source of this chloride is brine discharge from the rocks of Permian age in the vicinity of the lake. The U. S. Army Corps of Engineers has planned a chloride-control project. The Corps requested that the U. S. Geological Survey use a digital model to project the effects of the chloride-control plan on ground water. Ground-water flow and groundwater transport models were calibrated to represent the Quaternary aquifer which is the near-surface part of the flow system. The models were used to project the effects of planned chloride-control structures. Based on model results, groundwater levels are projected to rise as much as 19 feet. However, these water-level rises will occur only in areas near three reservoirs. Changes in ground-water level caused by the project will be small over most of the area. Chloride concentration of ground-water is projected to increase by over 90,000 milligrams per liter at one location. However, significant increases in chloride concentration are projected to be limited to areas where the ground-water already has high chloride concentrations. (USGS)
W83-02988

THE QUALITY OF WATER OF THE RIO BRAVO BASIN (LA CALIDAD DE LAS AGUAS DEL BAJO RIO BRAVO),
For primary bibliographic entry see Field 6E.
W83-03019

WATER QUALITY IMPROVEMENT IN THE FIRTH OR FORTH: A DISCRIMINANT FUNCTIONAL ANALYSIS,
Napier Coll. of Commerce and Technology, Edinburgh (Scotland).
P. A. Read, and T. Renshaw.
Environmental Pollution, Series B, Vol 4, No 4, p 291-301, 1982. 1 Fig, 5 Tab, 4 Ref.

Descriptors: *Outfall, *Ocean dumping, *Wastewater disposal, Fate of pollutants, Water pollution sources, Edinburgh, *Scotland, Firth of Forth, Statistical analysis, Wastewater treatment, Primary wastewater treatment, Water quality.

Water samples were collected at 8 sites in the intertidal zone on the south shore of the Firth of Forth in 1973-75 and 1978-80, before and after introduction of a sewage treatment scheme for Edinburgh, Scotland. The new treatment system, primary treatment and discharge of effluent through a 2800 m sea outfall, replaced 9 short outfalls discharging raw effluent near the shore. The mean sample values for fecal coliforms, BOD, inorganic suspended solids, organic suspended solids, inorganic phosphate, nitrate plus nitrite, and salinity measured before and after were compared by discriminant functional analysis to assess the extent of change. Mahalanobis distance measures were used for this comparison. At 2 of the 8 sites water quality was significantly improved by construction of the sewage disposal system. These sites were especially high in fecal coliforms, 11,963 and 43,658 per 100 ml. At 2 other sites differences before and after were almost statistically significant. After the change, there were no statisically significant differences in general water quality among the sites. A fertilizer factory, inshore outfalls for crude sewage, and suspended solids and nitrogen from rivers were continuing sources of pollution, not affected by the construction of the longer outfall. (Cassar-FRC)
W83-03059

EVALUATION OF EPA UN-IONIZED AMMONIA TOXICITY CRITERIA,
Szumski (Dan) and Associates, Walnut Creek, CA.
D. S. Szumski, D. A. Barton, H. D. Putnam, and R. C. Polta.
Journal of the Water Pollution Control Federation, Vol 54, No 3, p 281-291, March, 1982. 6 Fig, 3 Tab, 19 Ref.

Descriptors: *Water quality standards, *Fish, *Ammonia, *Toxicity, Water pollution effects, Gills, Effluent limitations, Standards, Alkalinity, Water temperature, Temperature, Alkalinity, Hydrogen ion concentration.

The EPA Red Book uses a concentration of 0.08 mg per liter of un-ionized ammonia at the gill surface of fish as the water quality criterion for protection of salmonid fisheries. Total ammonia levels that achieve this standard are given for various pH at 20C. This paper reviews acute and chronic toxicity data and concludes that these values are overly restrictive in warm water fisheries during periods of high temperatures and high pH, adding significantly to costs of advanced wastewater treatment plants. A more suitable alternative is suggested. It considers ammonia concentrations as a function of pH, temperature, and alkalinity. For example, at 20C and alkalinity of 200 mg per liter CaC03, the allowable total ammonia concentrations would be 2.7 mg per liter at pH 8.5; 5.0 mg per liter at pH 8.0; and 10.0 mg per liter at pH 7.5. Permissible ammonia values are lower for water at high temperature and/or alkalinity. The Red Book criteria are 4 mg per liter total ammonia at pH 7 and 0.1 mg per liter at pH 8.6. (Cassar-FRC)
W83-03091

ALUM CONTROL OF INTERNAL PHOSPHORUS LOADING IN A SHALLOW LAKE,
Washington Univ., Seattle. Dept. of Civil Engineering.
E. B. Welch, J. P. Michaud, and M. A. Perkins.
Water Resources Bulletin, Vol 18, No 6, p 929-936, December, 1982. 8 Fig, 2 Tab, 20 Ref.

Descriptors: *Phosphorus removal, *Alum, *Lake restoration, Shallow water, Eutrophic lakes, Macrophytes, Algae, Chemical precipitation, Flocculation, Aquatic plants, Fate of pollutants, Water treatment, Water quality control.

Alum was applied at 5.5 mg per liter in September 1980 to eutrophic Long Lake, Washington (2 m mean depth, 137 ha area) to control internal phosphorus loading. Mean summer total P and chlorophyll a decreased from 76 and 27 micrograms per liter, respectively, in 1978 before treatment to 29 and 14 micrograms per liter. Mean summer Secchi transparencies increased from 1.6 to 2.2 m. After treatment cryptomonads, diatoms, and green algae became relatively more abundant at the expense of blue-green algae. Macrophyte biomass, reduced by 84% after a 4 month drawdown in 1979, returned to the previous levels within a year after alum treatment. It is not known whether decomposition of macrophytes during the winter of 1982 will increase the P loading in the following summer. If this loading does not occur, it can be assumed that the aluminum hydroxide floc was an effective control of P. The increased transparency may encourage proliferation of macrophytes, with negative impacts in recreational use and relapse of P during decomposition. Long-term improvements may be produced by harvesting the macrophytes each season or by removing the top half meter of the sediment layer. (Cassar-FRC)
W83-03140

A MODELING APPROACH FOR STORM WATER QUANTITY AND QUALITY CONTROL VIA DETENTION BASINS,
Princeton Univ., NJ. Dept. of Civil Engineering.
R. A. Ferrara, and A. Hildick-Smith.
Water Resources Bulletin, Vol 18, No 6, p 975-981, December, 1982. 7 Fig, 5 Tab, 7 Ref.

Descriptors: *Storm water, *Detention reservoirs, *Urban hydrology, Model studies, Mathematical models, Storm wastewater, Design criteria, Nonpoint pollution sources, Water quality control, Water management.

A mathematical model is presented to help designers plan storm water detention basins for the dual purposes of storm water quality and quality control. Results show that, for a given basin, removal increases as storm frequency increases, i.e., storm size decreases. For large storms, particles have less time and greater depths over which to settle in the basin. The degree of pollutant removal for any particular constituent (for example, solids, COD, total Kjeldahl nitrogen, and total phosphorus) is a function of the particle size for that constituent. For particles < 1 micron little removal is obtained; for particles > 105 microns, nearly complete removal is obtained. Solids removal is high; total P removal is low. The design procedure is illustrated with a hypothetical 1 sq mi watershed undergoing development. (Cassar-FRC)
W83-03147

RUNOFF AND WATER QUALITY FROM THREE SOIL LANDFORM UNITS ON MANCOS SHALE,
Bureau of Land Management, Denver, CO. Div. of Special Studies.
For primary bibliographic entry see Field 2J.
W83-03150

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

USE OF EPA'S CAPDET PROGRAM FOR EVALUATION OF WASTEWATER TREATMENT ALTERNATIVES,
Tulane Univ., New Orleans, LA. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W83-02804

THE USE OF WATER QUALITY MODELS IN MANAGEMENT DECISION MAKING,
Environmental Research Lab., Athens, GA.
For primary bibliographic entry see Field 5G.
W83-02847

APPLICATION TO RIVERS AND UNDERGROUND WATERS,
Brussels Univ. (Belgium). Lab. of Hydrology.
For primary bibliographic entry see Field 5G.
W83-02866

MATHEMATICAL MODELLING OF ESTUARIES AND COASTAL WATERS,
Newcastle upon Tyne Univ. (England). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2L.
W83-02867

MANAGEMENT OF EXISTING RESERVOIR SYSTEMS BY INTERACTIVE OPTIMIZATION,
Purdue Univ., Lafayette, IN. Water Resources Research Center.
S. M. de Monsabert, M. H. Houck, and G. H. Toebes.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-203398, Price codes: A10 in paper copy, A01 in microfiche. Technical Report No 149, March 1983. 195 p, 38 Fig, 25 Tab, 77 Ref, 6 Append. OWRT A-060-IND(1).

Descriptors: *Reservoir operation, *Objective function, *Probabilistic processes, *Optimization, Decision making, Eagle Creek Reservoir, Droughts, Floods, *Inflow forecasting, Indianapolis, *Indiana, *Simulation analysis.

A new methodology is developed for use in optimizing reservoir operations. This method utilizes an original function that is derived from reservoir managers' goals. By interpreting the operating desires of decision makers in terms of probabilistic benefits, Probabilistic Optimization Objective Functions (POOFs) are defined. One advantage of POOFs is that they do not require an extensive economic analysis. POOFs were developed for the Eagle Creek Reservoir located near Indianapolis, Indiana. For the Eagle Creek Reservoir case study the following conclusions may be drawn: 1. Probablistic Optimization Objective Functions (POOFs) were easily constructed. 2. Simulated POOF optimizations of daily operations reduced floods significantly over heuristic policies when both had the advantage of ideal inflow forecasts. 3. POOF optimization results can be assembled into release rule curves capable of reducing droughts and floods to a greater extent than heuistic or historic policies. 4. Special POOFs which guide the reservoir operations during extreme conditions reduced the effects of simulated droughts and floods with ideal inflow forecast knowledge.
W83-02924

OPTIMAL ANNUAL OPERATION OF A WATER SUPPLY AND DISTRIBUTION SYSTEM,
Mekoroth Water Co., Haifa (Israel).
S. Meyers, and U. Shamir.
Advances in Water Resources, Vol 5, No 4, p 240-247, December, 1982. 6 Fig, 4 Ref.

Descriptors: *Water supply development, *Water distribution, Water resources development, Model studies, *Optimization, *Optimum development plans, Planning, Resources development, *Israel.

A model is described for determining the optimal operation of Israel's National Water System over 1 year, with monthly time increments. The water system contains the Main National Carrier which is about 250 km long from the Kinneret in the north to the Negev in the south, and some 25 regional water systems connected to it. Water is taken from the Kinneret and from two aquifers. Water transfers may take place between the National Carrier and regional systems, and between interconnected regional systems. The mathematical model of the system represents its monthly production and transfer capacities. Given the monthly demands which have to be met and the hydraulic constraints, the model determines the month-by-month operating plan, which minimizes energy costs over the year. The optimization model is formulated as a linear program. This necessitates several types of approximations and linearizations, which are described in detail. The optimal operating plan for 1977-78 is compared with the actual operation of the year, and conclusions are drawn from the comparison concerning the practicality and adequacy of the model's output and the potential for effective operation annd for energy savings. The analysis of the 1977-78 operation year indicates a potential savings of 6% of the total energy requirement for the system. It is felt that this is sufficiently high to warrant further effort in implementing the required planning program, in which the model would play a central role. (Baker-FRC)
W83-03062

TEN ECOSYSTEM APPROACHES TO THE PLANNING AND MANAGEMENT OF THE GREAT LAKES,
Toronto Univ. (Ontario). Inst. for Environmental Studies.
B. J. Lee, H. A. Regier, and D. J. Rapport.
Journal of Great Lakes Research, Vol 8, No 3, p 505-519, 1982. 4 Fig, 47 Ref.

Descriptors: *Lakes, *Management, *Planning, *Great Lakes, Decision making, Water management, *Ecosystems, Environmental effects.

Ten ecosystem approaches are considered for Great Lakes basin management problems. Similarities, differences and at times, insufficiencies in these approaches are identified, and some general features of comprehensive ecosystem approaches for Great Lakes issues are recommended. The ecosystem approach bridges the disciplines of natural and human ecology to form an integrated or transdisciplinary approach to the study of natural systems. The general features of such approaches include concepts and methods of appropriate spatial and temporal scope as well as scale and detail; analytically, sufficient specification of the ecosystem with system to external naturally, sufficient specification of the ecosystem with respect to external natural processes and components, and ecosystemic man-nature interactions; holistically, adequate comprehension of internal evolutionary/successional processes, responsiveness/adaptiveness to external factors, and recovery sequences after relaxation of external stress; and information sets including maps of spatial ecosystem features, monitored time series of diagnostic features, models of relational/casual processes, and management case

studies. The approaches also include various aspects concerned with managment objectives, political-administrative processes, and disciplines/professions. (Baker-FRC)
W83-03082

6B. Evaluation Process

AN ECONOMIC ANALYSIS OF INTEGRATED FISHERIES MANAGEMENT: THE CASE OF THE LAKE MICHIGAN ALEWIFE AND SALMONID FISHERIES,
Hawaii Univ., Honolulu. Dept. of Agricultural and Resource Economics.
K. C. Samples, and R. C. Bishop.
Journal of Great Lakes Research, Vol 8, No 4, p 593-602, 1982. 1 Fig, 1 Tab, 17 Ref.

Descriptors: *Fish management, *Lake fisheries, *Economic evaluation, Benefits, Fisheries, Model studies, Recreation, Fishing, Commercial fishing, Sport fishing, Predation, Alewife, Salmon, Anadromous fish, Fish harvest, Fish populations, Trout, Salmonids, *Lake Michigan.

Salmonids in Lake Michigan consume an estimated 110-112 million pounds of alewives each year. To determine appropriate levels for salmonid stocking and harvesting and commercial alewife landings an optimal control model was developed. The model shows that: (1) in both fisheries optimal harvest benefits equalled marginal harvest costs, including any interfishery externalities imposed on the other fishery; (2) a lower alewife harvest is preferable in the joint case than if harvest rates were determined for both fisheries independently (increasing the salmonid harvest increases the available alewives); (3) obtaining a value of fish landed in each fishery is vital to computing the marginal social benefits. The marginal return social values per 5 pounds of fish are: salmonids, $4.10, and alewives, nearly zero. This indicates that it would be more economically efficient to use the alewife biomass as a salmonid food than as a commercial harvest. However, the economic visibility of the lake's commercial fisheries is not considered in this model. (Cassar-FRC)
W83-02811

BALANCING BENEFITS AND EXPENDITURE IN WATER POLLUTION CONTROL,
C. Lefrou.
Water Science and Technology, Vol 14, No 9-11, p 1245-1255, 1982. 3 Fig, 29 Ref.

Descriptors: *Water pollution control, *Evaluation, *Economic aspects, Planning, Management, Water management, Decision making.

Variables existing in the differenct possible kinds of expenditures for the control of water pollution can fluctuate considerably within neighboring geographic areas for various reasons, such as the extent of water demand and the uses of the rivers by riparian owners. Expenditures include building, extension and maintenance of sewerage systems and urban sewage treatment works, sewerage construction in appropriate places, building industrial sewage treatment works and pretreatment facilities, removal of urban and industrial wastes to central disposal sites, laying out garbage dumps, treatment of rainwater in certain localities, and the maintenance of streams and their surroundings. Benefits derived from meeting these expenses include recreational benefits, diversionary uses, improved health, household benefits, industrial and commercial fisheries profits, and aesthetic benefits. Various methods of assessing the benefits provided by a pollution control policy are considered. (Baker-FRC)
W83-02862

THEME 3: THE ECONOMICS OF WATER POLLUTION CONTROL AND RESEARCH: INTRODUCTION BY THE SESSION CONVENOR,
Technische Hochschule, Darmstadt (Germany, F.R.). Inst. fuer Wasserversorgung, Abwasserbeseitigung und Raumplanung.
G. Rincke.
Water Science and Technology, Vol 14, No 9-11, p 1219-1223, 1982. 13 Ref.

Descriptors: *Water pollution control, *Planning, *Economic evaluation, Economic justification, Economic impact, Economic feasibility, Economic aspects, Decision making, Management, Administration, Water management.

There are three major objectives to be achieved in economic considerations on water planning and management; to improve the basis for decision making, to inform the political decision makers and the population regarding the necessity and future priorities of water pollution control and research, and to gain a realistic concept for cost allocation to the users of a technical system who may be partially responsible for regional pollution or those who are receiving special benefits. As an outcome of these considerations a multi-dimensional balance calculation has been developed in which the costs and benefits are evaluated separately in terms of economic effects, ecologic effects, social effects, and effects on regional development. The keys for an efficient transfer of knowledge seem to be to start from good and steady cooperation between the scientists involved, to test systems developed using practical examples according to the objectives that apply to a broad range of different problems, to correct the models after evaluation using the experience of practical tests, and to apply critical judgment to decide whether a system which has been designed to solve highly sophisticated problems can be simplified for use in less demanding applications. The relationship between the modelling and the value of information it provides should be clearly stated as positive, i. e., the benefit-cost relationship. It is concluded that the critical sense of the population, the growing interrelations among different fields of human activities, and the difficult control of complicated and dangerous side effects increases the need for such multi-dimensional side effects increases the need for such multi-dimensional planning of bigger projects. (Baker-FRC)
W83-02869

PROBLEMS, ISSUES, CONSTRAINTS, AND BARRIERS TO WATER QUALITY PLANNING AND MANAGEMENT IN URBAN AND URBANIZING AREAS (SMSA'S) IN TENNESSEE,
Tennessee Univ., Knoxville. Graduate School of Planning.
G. E. Bowen, G. E. Ferguson, and T. R. Gangaware.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-196519, Price codes: A10 in paper copy, A01 in microfiche. Water Resources Research Center Research Report No 90, Univ. of Tennessee, Knoxville, March, 1983. 204 p, 8 Fig, 7 Tab, 23 Ref. 2 Append. OWRT A-062-TENN(1), 14-34-0001-1145.

Descriptors: Water quality management, *Urban planning, *Institutional constraints, *Tennessee, Urbanizing areas, Literative reviews, *Surveys, Urban runoff, Low flows, Toxic substances, Industrial wastes, Abandoned dump sites.

Results are presented of a statewide study based on the systematic gathering of information on water quality management issues, problems, and barriers from three sources: a literature review, a questionnaire sent to experts within the state, and five case studies of '208' agencies within Tennessee. The study points out considerable variation among water basins, related to both water quality and the causes and treatment of problems. The major problems identified were: erosion and sediment, agricultural and forest runoff, sludge, flooding, construction runoff, low dissolved oxygen, flood plain development, eutrophication, algal growth and contamination from hazardous wastes. The major issues and barriers identified were: resistance to government regulations, lack of understanding regarding cause/effect relationships, imbalance between economic development and environmental protection, low priority of water quality, poor cooperation between industry and government agencies weak enforcement of regulations, and the need for stronger legislation. Major problems identified for metropolitan areas include: urban and construction runoff, low stream flows, toxic substances, abondoned dumps, and industrial contaminants. The barriers to obtaining high quality streams in metropolitan areas include: inadequate financial support, lack of political commitment, and well organized and financed opposition to water quality management. In addition, management agencies were fragmented, urban and rural conflicts existed, and suburban growth is poorly controlled.
W83-02899

AGRICULTURAL VS. HYDROPOWER TRADEOFFS IN THE OPERATION OF THE HIGH ASWAN DAM,
Metcalf and Eddy, Inc., Boston, MA.
K. Oven-Thompson, L. Alercon, and D. H. Marks.
Water Resources Research, Vol 18, No 6, p 1605-1613, December, 1982. 5 Fig, 7 Tab, 13 Ref.

Descriptors: *Reservoir operation, *Agriculture, *Hydroelectric power, Reservoir releases, Benefits, Cost-benefit analysis, *Aswan Dam, Nile River, *Egypt, Toshka Spillway, Model studies, Electric power production, Optimization, Seasonal variation, Flood control, Irrigation.

Present operation of the High Aswan Dam is based on satisfying irrigation needs, with hydropower generation as a residual benefit. Releases are very high in the summer months, 5.3 to 7.0 billion cu m, compared with 3.0 to 4.3 billion cu m the rest of the year. This paper defines the tradeoff between hydropower and agriculture under present water availability conditions and explores the results of various operating policies (reductions of 5, 15, and 25% in releases May through August) using a stochastic dynamic programming model. If summer irrigation allocations are reduced by 25% and cropping patterns are restructured to fit this reduction, a gain of 11-20% in firm monthly hydropower production is realized. Benefit/cost ratios from a 5-10% reduction in agricultural water are 0.71-0.86 if cotton irrigation only is reduced or if maize replaces rice. A slight increase of the value of hydropower from the present 0.035 Egyptian pounds per kWH would produce benefit/cost ratios of greater than unity. The Toshka Spillway, designed to serve as a safety valve for unusually high water conditions, appears to reduce power generation under the dynamic programming scheme. This aspect of the reservoir operation should be investigated. It is also recommended that the 300-400 GWH generated in summer replace the output of thermal power stations during that season, saving 30-40 million Egyptian pounds each summer. (Cassar-FRC)
W83-02934

OBTAINING AN ANALYTICAL GRASP OF WATER DISTRIBUTION SYSTEMS,
Pitometer Associates, Columbia, MD.
For primary bibliographic entry see Field 5F.
W83-03066

ECONOMIC AND ENVIRONMENTAL ISSUES OF THE PROPOSED EXTENSION OF THE WINTER NAVIGATION SEASON AND IMPROVEMENTS ON THE GREAT LAKES-ST. LAWRENCE SEAWAY SYSTEM,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 6G.
W83-03072

AN ASSESSMENT OF THE ECONOMIC MAGNITUDE OF ENVIRONMENTAL DAMAGE FROM ACID PRECIPITATION IN THE ADIRONDACKS,
F. C. Menz, and J. K. Mullen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-208553, Price codes: A02 in paper copy, A01 in microfiche. Center for Environmental Research Completion Report, Cornell Univ., Ithaca, N.Y., May 1983. 11 p, 6 Ref. OWRT B-103-NY(1).

Descriptors: *Acid precipitation, *Economic aspects, *Fishery damages, *Adirondack Mountains,

Travel-cost method, Recreation demand, *New York, Lakes, Ponds, Environmental effects, Air pollution.

This research represents one of a few initial attempts to quantify economic damages resulting from increased acidification of lakes and ponds ostensibly due to acidic deposition. The Adirondack mountains have been identified as one of the most impacted and vulnerable areas in the northeastern U.S. to suffer acidification damages to its aquatic ecosystem. The focus of this research is the loss in economic welfare resulting from diminished recreational angling opportunities within the Adirondack fishery. An amended travel-cost model was applied to a survey of licensed anglers in New York State to determine the economic value of the fishery prior to the general acknowledgement of widespread acidification damages. The empirical model reflects the importance of available angling opportunities, as generally measured by water surface acreage, in explaining variations in demand patterns. Data pertaining to those water bodies that have become acidified were used together with the parameters of the empirical model to generate the change in visitation and economic value resulting from increased acidification. Annual losses in economic value due to the acidification-related reduction in recreational angling opportunities were estimated to be in the range of $1.6 to 3.2 million. For a variety of reasons, however, these estimates should be interpreted as a lower bound of the actual social losses incurred annually from acidification damages to this freshwater ecosystem.
W83-03095

THE NATIONAL RECREATIONAL FISHING BENEFITS OF WATER POLLUTION CONTROL,
Resources for the Future, Inc., Washington, DC.
C. S. Russell, and W. J. Vaughan.
Journal of Environmental Economics and Management, Vol 9, No 4, p 328-354, 1982. 1 Fig, 9 Tab, 33 Ref.

Descriptors: *Fishing, *Water pollution control, *Benefits, Water quality, Model studies, Biochemical oxygen demand, Water pollution effects, Legislation, Recreation, Cost-benefit analysis.

An effort to estimate the freshwater recreational fishing benefit subcategory is reported. The method used is potentially applicable to other subcategories. The method required the answers to the following questions: what are the mechanisms by which control of water pollution discharges creates benefits for actual or potential recreational fishermen; what tools and data could be used to capture those mechanisms; and what special difficulties would be encountered because of the emphasis on obtaining a national benefit total. A schematic view is presented of an attempt to estimate national recreational fishing benefits from water pollution control. Projections are made of the national impact of pollution control on total fishable fresh water and on its split among dominant species. Annual benefits of water pollution control accuring via recreational fishing are projected as well. One major problem in this type of program is the roughness of the connection between pollution discharges and predicted ambient conditions expressed in terms of fishery class. (Baker-FRC)
W83-03130

BENEFITS OF POLLUTION CONTROL ON MASSACHUSETTS' HOUSATONIC RIVER: A HEDONIC PRICING APPROACH,
Economic Research Service, Washington, DC.
P. R. Rich, and L. J. Moffitt.
Water Resources Bulletin, Vol 18, No 6, p 1033-1037, December, 1982. 1 Tab, 9 Ref

Descriptors: *Benefits, *Property value, *Water pollution control, Hedonic price theory, Regression analysis, Land appraisals, Recreation, Housatonic River, *Massachusetts.

The Hedonic price theory, a property value technique, was used to measure the benefits of a water pollution control project started in 1973 on the Housatonic River, Massachusetts. The methodology was based on the assumption that the benefits of improved water quality may be inferred from changes in land values. Since only the benefits enjoyed by land owners and recreationists are considered, the benefits are probably a lower bound estimate. Substantial benefits were calculated: $37 per acre for riparian land, $31 per acre for nonriparian land, and $600,000 for regional benefits. No abatement costs for ex-post distributional impacts were considered. (Cassar-FRC)
W83-03141

THE POTENTIAL IMPACT OF WATER REALLOCATIONS ON AGRICULTURE IN IDAHO,
Idaho Univ., Moscow. Dept. of Agricultural Economics.
R. B. Long.
Water Resources Bulletin, Vol 18, No 6, p 971-974, December, 1982. 1 Fig, 4 Tab, 2 Ref.

Descriptors: *Economic effects, *Farms, *Water allocation, Property value, Irrigation, Income, Monetary returns, Prices, Cropland, Dry farming, Arid lands, *Idaho.

The economic impact os shifting water allocations in Idaho from the present commitment to agriculture to other uses (power, industry, and recreation) was studied using an irrigated-dryland market equilibrium model. Reducing irrigated acreage and increasing dryland areage greatly reduces farm income and equity in farming where yields from irrigated and dryland farming are widely different. A reduction of irrigated acreage from 3.0 to 2.5 million acres would reduce farm income from $700 million to $430 million. A 16 and 2/3% decrease in land would decrease income by 38.6%. Values in the graphical model are based on 1967 prices and should be multiplied by 2.834 to correspond with present values. (Cassar-FRC)
W83-03143

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

PRICE, SOCIOECONOMIC, AND CLIMATIC INFLUENCES ON RESIDENTIAL WATER USE IN SOUTHERN ARIZONA,
Arizona Univ., Tucson.
For primary bibliographic entry see Field 6D.
W83-02894

FEDERAL WATER POLICY AND NEW MEXICO WATER,
For primary bibliographic entry see Field 6E.
W83-02922

THE LEGISLATIVE REALITY OF A NATIONAL WATER POLICY,
Senate, Washington, DC.
For primary bibliographic entry see Field 6E.
W83-02923

HYDROLOGIC AND WATER QUALITY MODELING FOR INSTREAM FLOW STRATEGIES,
Duke Univ., Durham, NC. Dept. of Civil and Environmental Engineering.
M. A. Medina, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-203422, Price codes: A20 in paper copy, A01 in microfiche. Water Resources Research Institute Report No 183, North Carolina State Univ., Raleigh, December 1982. 246 p 90 Fig, 17 Tab, 89 Ref. 10 Append. OWRT A-117-NC(1), 14-34-0001-1135.

Descriptors: *Instream flow, *Instream aeration, *Frequency analysis, *Fisheries, Fishkill, Model studies, Rainfall-runoff relationships, Hydrologic data, Water quality, Biological oxygen demand, Computer programs, Dissolved oxygen, *North Carolina, Yadkin-Pee Dee River basin.

In the past, instream flow assessments have considered only water quantity and ignored fluctuating water quality. This study used data from the Yadkin-Pee Dee River basin, North Carolina to develop a framework to integrate water quality and quantity in the evaluation of instream flow needs. Synoptic rainfall data analysis allows characterization of storm event variables: volume, duration, intensity and time between events. Continuous hydrologic and water quality simulation models are used to produce three dimensional computer graphics as well as frequency and duration curves of streamflow and water quality constituents (e.g. dissolved oxygen, biochemical oxygen demand). Water quality criteria for freshwater fish are discussed, and a means of evaluating proposed flow and pollution levels is provided since continuous simulations can be used to predict violations of established stream standards. Programming considerations and instructions for operation of the models are presented at length.
W83-02927

A MODEL OF COSTS FOR TREATING DRINKING WATER,
Municipal Environmental Research Lab., Cincinnati, OH.
For primary bibliographic entry see Field 5F.
W83-03089

COSTS FOR SUPPLYING ALTERNATIVE COMMUNITY WATER AND SANITATION SYSTEMS IN BRAZIL,
K. A. Demke, and D. T. Lauria.
Journal of the American Water Works Association, Vol 74, No 4, p 171-177, April, 1982. 8 Tab, 4 Ref.

Descriptors: *Developing countries, *Costs, *Economic aspects, Water distribution, Sanitation, *Brazil, Construction costs, Operating costs, Alternative planning, Planning.

Five alternative community water systems suitable for developing countries were compared, using detailed data collected during a study for a system installed in a small Brazilian town. Mathematical models developed from data describing 64 other Brazilian communities, most with populations of 5 to 10 thousand, were used to determine costs. The levels of service were: (1) public standpost, ventilated pit latrines, 25 liters per capita per day; (2) yard hydrants, pour flush toilets with soakaway, 50 liters per capita per day; (3) sanitary cores, pour flush toilets with septic tanks, 100 liters per capita per day, (4) sanitary cores, sewered pour flush toilets, 100 liters per capita per day; and (5) full plumbing, conventional sewage, 200 liters per capita per day. Total water and sanitation construction costs per capita were $21, $42, $74, $101, and $139 for the 5 levels of service, respectively. Annual operations costs were $43,000 to $190,000 for levels 1 to 5. Costs of constructing and operating the components of each system are given in detail to aid in choosing a system for each community according to individual needs. The largest increase in convenience and health benefits occurs between levels 1 and 2. Therefore, level 2 (yard hydrants) is a good choice where incomes are low, on the order of $1000 per year. These alternatives may be rapidly evaluated using computer programs. (Cassar-FRC)
W83-03092

6D. Water Demand

PRICE, SOCIOECONOMIC, AND CLIMATIC INFLUENCES ON RESIDENTIAL WATER USE IN SOUTHERN ARIZONA,
Arizona Univ., Tucson.
R. B. Billings, and W. M. Day.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-196469. Water Resources Research Center Completion Report, Univ. of Arizona, Tucson, November 1982. 91 p, 19 Tab, 7 Fig, 33 Ref. OWRT A-104-ARIZ(1), 14-34-0001-1103.

Descriptors: *Water demand, *Elasticity of demand, *Water pricing, Municipal water, *Arizona, Climates, *Water use, *Residential water use, Model studies, *Marginal costs, *Block rate price

schdules, *Multiple regression demand models, Social values.

Several demand models for water in the presence of block rate price schedules were theoretically examined and empirically estimated. The alternative price concepts are average price and marginal price/difference. Difference is the implicit block rate tax or subsidy due to the availability-of-service charge and/or intramarginal blocks in the rate structure. Three variants of marginal price/difference were used: 1) marginal price and difference derived directly from the rate schedule for each quantity; 2) marginal price and difference derived from a regression of the total revenue function against corresponding values of quantity for each rate schedule; and 3) marginal price and difference as in (1) above, but with omission of observations where quantity is 'close' to the discontinuities in the rate schedule. This third variant of the model should produce unbiased estimates by eliminating observations where measurement error or omitted variables may cause quantity to fall in the 'wrong' use block, resulting in incorrect assigned values for marginal price and difference. Water use data and matching demographic and economic data for 1974-1980 were analyzed for each of 13 districts in Southern Arizona. Multiple regression demand models were estimated for each district and in a combined time-series, cross-section with each theoretical model. Strong statistical estimates of the price elasticities of demand were obtained for each model and district, along with estimates of the impact of various climatic, cultural, and economic influences on water use.
W83-02894

ESTIMATED WATER USE IN FLORIDA, 1980,
Geological Survey, Tallahassee, FL. Water Resources Div.
S. D. Leach.
Florida Bureau of Geology Map Series No 103, 1982. 1 Sheet, 6 Fig, 1 Tab, 5 Ref.

Descriptors: *Water use, *Consumptive use, *Water demand, Municipal water, Irrigation water, Industrial water, Water supply, Thermal powerplants, Saline water, Surface water, Freshwater, *Florida.

On the average 7,309 million gallons of freshwater is withdrawn for use in Florida each day for the combined use for public supplies, rural domestic and livestock, industrial self-supplied, irrigation, and thermoelectric power generation. The largest use of freshwater in Florida was for irrigation--2,997 million gallons per day which also is responsible for the greatest consumption 1,155 million gallons on the average each day. The remaining use of freshwater amounted to 1,859 million gallons per day for thermoelectric power generation; 1,361 million gallons per day for public supply; 781 million gallons per day for industrial use other than theromoelectric power generations; and 310 million gallons per day on the average, for rural domestic. (USGS)
W83-02990

SURFACE WATER AVAILABILITY AND FUTURE DEMAND ALONG THE BORDER FROM JUAREZ TO MATAMOROS (DISPONIBILIDAD DE AGUAS SUPERFICIALES Y SU DEMANDA FUTURO A LO LARGO DE LA FRANJA FRONTERIZA DESDE CIUDAD JUAREZ, CHIHUAHUA, HASTA MATAMOROS, TAMAULIPAS),
Escuela Superior de Agricultura Hermanos Escobar, Chihuahua (Mexico). Area de Manejo de Agua y Suelo.
For primary bibliographic entry see Field 6E.
W83-03022

6E. Water Law and Institutions

CLEAN WATER ACT - THE VIEW FROM HERE,
Johns Hopkins Univ., Baltimore, MD. School of Engineering.
A. Wolman.
Journal of the Water Pollution Control Federation, Vol 55, No 1, p 14-16, January, 1983. 4 Ref.

Descriptors: *Financing, *Water pollution control, Clean Water Act, Federal jurisdiction, State jurisdiction, Jurisdiction, Wastewater treatment, Economic aspects, Local governments, Water policy, Management.

Funding for water pollution control is shifting from the federal government to the states and their subdivisions. Annual expenditures for wastewater treatment were $0.5-1.5 billion (corrected for inflation) in 1943 when no federal grants were available and $2.43 billion projectd for 1984. This shows that considerable non-federal money has hisotrically been used for pollution control. The states must recapture their responsibility for financing wastewater treatment plant construction and operation. A handful of states (six) has raised over $2 billion through bond issues, refuting the contention that local governments are largely bankrupt. Other innovative financing approaches are being developed to suit local situations. The few cases of bankruptcy in municipalities are usually a result of poor management. The pollution control profession should resume its role within the familiar and historical frameworks which have been productive through the years, since it is unlikely that federal aid will be resumed. (Cassar-FRC)
W83-02832

LEGAL AND ADMINISTRATIVE CONTROL ASPECTS OF OIL POLLUTION,
Department of Energy, London (England). Petroleum Engineering Div.
For primary bibliographic entry see Field 5G.
W83-02868

LEGAL AND ADMINISTRATIVE ASPECTS,
National Swedish Environment Protection Board, Solna.
For primary bibliographic entry see Field 5G.
W83-02874

FEDERAL WATER POLICY AND NEW MEXICO WATER,
S. E. Reynolds.
In: Symposium on Coping With Federal Water Policy Changes, November 1982. Report No 158, February 1983. p 16-24. New Mexico Water Resources Research Institute, New Mexico State University, Las Cruces, NM.

Descriptors: *Water policy, *Water law, *Federal jurisdiction, Water resources development, Water rights, State jurisdiction, Administrative agencies, Administrative regulations, Operating policies, Legal aspects, Capital costs, Total costs, *New Mexico.

Since 1955, about $1.4 billion worth of water projects have been completed, are under construction or have been authorized for construction in New Mexico. The state will probably never need to seek authorization for major new irrigation projects, but it may need costly municipal and industrial water supply projects. The Department of Interior has pledged its support of western states water laws. However, of concern to New Mexico and other western states is DOI's proposed policy on cost-sharing on federal water projects. A Cabinet Council memorandum from DOI Secretary Watt recommends that the non-federal share of capital costs for municipal water supply be 100% of the cost; for industrial supply and hydroelectric power, the share be no less than 100%; and the share of cost for urban and rural flood protection and for agricultural water supply projects be variable but no less than 35%. To reduce the federal budget, the non-federal contribution would be required upfront. In reality, though, it would have a minimal effect on the deficit. Water administrators feel the federal government shouldn't make a profit on these projects unless the profits accrue to the water resources agencies in the affected states. In question also is whether these new cost-sharing guidelines would be applied to projects already authorized by Congress, such as the Colorado River Basin Project Act. Another concern is that of seeking Congressional approval for water projects before implementation by the administration. The author favors S.621, the Domenici-Moynihan bill to authorize the National Water Resources Policy Act of 1981 over the Cabinet Council's guidelines. (Atkins-Omniplan)
W83-02922

THE LEGISLATIVE REALITY OF A NATIONAL WATER POLICY,
Senate, Washington, DC.
J. Hughes.
In: Sumposium on Coping With Federal Water Policy Changes, November 1982. Report No 158, February 1983. p 9-15. New Mexico Water Resources Research Institute, New Mexico State University, Las Cruces, NM.

Descriptors: *Water policy, *Water law, *Federal jurisdiction, *Water rights, Water resources development, *Cost allocation, State jurisdiciton, Administrative agencies, Administrative regulations, Operating policies, Legal aspects, Capital costs, Total costs, Construction costs.

The nation's water policy is a hodge-podge of laws, policies and programs. Many of the issues and questions have been talked about for years, such as what can government do to meet the nation's water needs and make the best uses of existing resources; are water projects being developed, repaired, and operated economically and efficiently; what portion of the federal budget is allocated to water and are cost allocations, repayment and financing policies meeting today's requirements; how much cost recovery from users is possible; what impact will water shortages have on the legislative system; what is the role of water conservation; and do out laws need streamling to eliminate built-in conflicts of purposes of these laws. Complicating the resolution of these issues is the fact that there are eight committees and 11 subcommittees in the House dealing with water, and four major committees and seven subcommittees in the Senate. In addition, there are the secretaries of the Interior, Agriculture and Army; the administrator of the EPA; the Commerce and Transportation departments; and various city, county and state officials. However, there is agreement on many issues, i.e., water prices will continue rising; the courts will remain involved; energy development and urban expansion will continue placing severe pressure on western water resources; water shortages are a national not a western problem; and water projects will have a hard time competing with other projects for federal dollars. The author is confident that Congress is better educated on the issues and will change the laws that need changing. (Atkins-Omniplan)
W83-02923

LAWS AND INSTITUTIONS THAT REGULATE SURFACE WATERS IN MEXICO (COMMENTARIOS A LAS LEYES E INSTITUCIONES QUE REGLAMENTAN LAS AGUAS SUPERFICIALES DE MEXICO),
F. Oyarzabal.
Natural Resources Journal, Vol 22, No 4, p 999-1005, October, 1982. English summary.

Descriptors: *Water law, *Water allocation, *Water use, Legal aspects, Water permits, Appropriation, Constitutional law, Institutional constraints, Equitable apportionment, Regulations, *Mexico.

The Constitution of Mexico provides that waters within its national boundaries belong to the nation, which may transfer its authority over the waters to individuals for public use only by indemnification. The main federal water laws are the Federal Law of Water and the Law of Conservation and Groundwater. The Department of Agriculture and Water Resources has responsibility for the regulation of water appropriation, the administration of groundwater, and the operation of filter works, waterways, and irrigation systems. The Department of Agriculture and Water Resources has the authority to enter into agreements with states, municipalities, local communities, and private individuals for the construction of water diversion and

development works. However, the Department must observe priorities for water use specified by the Federal Executive. Water appropriations, which may be cancelled if the water is not used for the specified objective for two years, are granted based on propriety of use and beneficial results of such use. Titles of appropriation specify standards relating to water pollution, duration of appropriations, and their conditions, as well as cost and volume limits. Transfer of the appropriation and deviation from its conditions without the approval of the Department are prohibited. (Carroll-FRC)
W83-03004

THE QUALITY OF WATER OF THE RIO BRAVO BASIN (LA CALIDAD DE LAS AGUAS DEL BAJO RIO BRAVO),
F. Oyarzabal.
Natural Resources Journal, Vol 22, No 4, p 925-937, October, 1982. English summary.

Descriptors: *Water allocation, *Water quality, *International agreements, Salinity, Appropriation, Irrigation water, Irrigation effects, *Mexico, Rio Bravo Basin, Water Treaty of 1945.

The Rio Bravo basin supplies Mexico and the United States with drainage according to the unequal terms set forth in the Water Treaty of 1945. The Mexico United States Treaty for the Utilization of Waters in the Colorado and Tijuana Rivers and the Rio Bravo provides for the allocation of Rio Bravo waters between Fort Quitman, Texas and the Gulf of Mexico. Each country is assigned one-half of the drainage from the two international dams, Amistad an Falcon. However, while the United States is assigned the total drainage from all tributaries on U. S. land, it also receives one-third of the drainage of six of the eight tributaries on Mexican land, with the stipulation that this part cannot be less than 432 million cubic meters annually. Problems of salinity and drainage in Rio Bravo Basin Irrigation District Number 25, consisting of 200,000 hectares in the northeastern part of the state of Tamaulipas, on the coast of the Gulf of Mexico, have been increasing steadily since 1965. Although the effective salinity of the available water is still low enough so that the waters are usable for crop irrigation, the ground has been deteriorating at a rate of 1,000 hectares annually since 1979. Restoration of District 25 has been undertaken through construction of drains, which are slowing salinization, and through technical integral assistance, which promotes a technology designed to restore, increase, and conserve land productivity. Rising water contamination levels due to urban and industrial development, along with increased salinity, create an urgent need for a means of water quality control. The 1945 Treaty needs revision to include a provision for regulating the quality of river water and to make a more equitable distribution of the Rio Bravo's water. (Carroll-FRC)
W83-03019

SURFACE WATER AVAILABILITY AND FUTURE DEMAND ALONG THE BORDER FROM JUAREZ TO MATAMOROS (DISPONIBILIDAD DE AGUAS SUPERFICIALES Y SU DEMANDA FUTURO A LO LARGO DE LA FRANJA FRONTERIZA DESDE CIUDAD JUAREZ, CHIHUAHUA, HASTA MATAMOROS, TAMAULIPAS),
Escuela Superior de Agricultura Hermanos Escobar, Chihuahua (Mexico). Area de Manejo de Agua y Suelo.
C. A. Rincon Valdes.
Natural Resources Journal, Vol 22, No 4, p 847-853, October, 1982. 9 Tab. English summary.

Descriptors: *International agreements, *Water allocation, Water rights, Appropriation, *Mexico, *Rio Grande River.

Under the treaties of 1906 and 1944, the United States and Mexico allocate rights to water in the Rio Grande on the basis of its rate of flow. The Treaty of Water for the Juarez Valley of 1906 stipulates the division of water, allocating 60,000 acre-feet of water to Mexico annually. The Mexican-United States Water Treaty of 1944 led to the construction of dams along the Rio Bravo from Fort Quitman, Texas, to the Gulf of Mexico. These dams store and regulate most of the surface flow of the Rio Bravo. Hydrometric recordings at the dams show that between 1954 and 1966 Mexico appropriated 47% of the total Rio Bravo drainage and the United States appropriate 53%. Only 58% of the total drainage was put to beneficial use: 1,226 million cubic meters were lost at the Falcon Dam, and 2,035 million cubic meters were lost in the Gulf of Mexico. The 20 hydrometric stations on the Rio Grande calculate water accounts and, thus, international water rights. (Carroll-FRC)
W83-03022

ASSESSMENT OF ECONOMIC, SOCIAL, AND INSTITUTIONAL IMPACTS OF GROUNDWATER REGULATION OF THE TILLMAN TERRACE AQUIFER IN SOUTHWESTERN OKLAHOMA,
Oklahoma State Univ., Stillwater. Dept. of Geology.
For primary bibliographic entry see Field 4B.
W83-03033

CHANGES PROPOSED FOR WATER MANAGEMENT IN THE UNITED KINGDOM,
N. Rowntree.
Journal of the American Water Works Association, Vol 74, No 12, p 14, 36, December, 1982. 2 Tab.

Descriptors: *Water management, *Management planning, *Legal aspects, England, Wales, Engineering, Legislation, Water policy, Planning, Management, Political aspects, *United Kingdom.

After some 20 years the Water Acts of 1963 and 1973 had been implemented and a system of apparent finality had been reached in the United Kingdom. This system enabled the uncoordinated activities of about 2000 local service organizations to be incorporated into 10 regional water authorities that manage all aspects of water use and development. Now an additonal change is suggested by the government. The proposal would replace the existing large number of local government representatives with nine to fifteen members appointed by the minister of the environment to each regional authority. Local consultation would be provied by divisional advisory committees. The National Water Council and the Water Space Amenity Commission would be dissolved. Appropriate legislation would be introduced at the earliest opportunity so that the changes could become effective within a year. While the public has shown little awareness of or interest in the subject of water management, such proposed changes are of considerable importance to the water organizations, their personnel and others involved in assessing their obligations and opportunities. (Baker-FRC)
W83-03065

6F. Nonstructural Alternatives

GUIDELINES FOR THE REDUCTION OF WASTEWATER TAX (HINWEISE ZUR REDUZIERUNG DER ABWASSERABGABE),
Bundesverband der Deutschen Industrie e.V., Cologne (Germany, F.R.).
K. R. Kabelitz.
Wasser, Luft und Betrieb, Vol 25, No 3, p 18-24, March, 1981. 1 Fig, 9 Ref. (No English Summary).

Descriptors: *Pollution taxes, *Wastewater pollution, *Water law, *Effluents, Legal aspects, Economic aspects, Water quality standards, Federal Republic of Germany, Texas, Wastewater treatment, Water pollution control.

Ways in which taxes levied on the various states of the Federal Republic of Germany for discharging wastewater into surface and ground waters can be kept to a minimum are discussed, focusing on ways provided by the law itself. Naturally, it pays to minimize discharges insofar as possible. The Wastewater Tax Law was enacted on January 1, 1981, and the first tax collection was expected in 1982. The law provided for tax exemption in certain cases, including the discharge of polluted water that was already equally polluted when it was taken from its original source, the discharge of polluted water into a surface water if the pollution arises from the washing of raw materials (consists of the raw material degradation products), discharge of rainwater through channels other than the public sewer system, and discharge of wastewaters into groundwater that is unsuitable for use as drinking water. Further provision is made for the nonlevying of tax for a period of three years before the expected startup of a wastewater treatment facility that would reduce the pollution load by at least 20%. Finally, the federal government has the power to waive tax until the end of 1989 if payment would cause 'considerable disadvantageous economic developments' -- as long as efforts are being made to reduce pollution. Some remarks concerning tax collection are given. (Gish-FRC)
W83-02801

FUNDING WATER POLLUTION CONTROL IN SOUTH AFRICA,
Department of Water Affairs, Forestry and Environmental Conservation, Cape Town (South Africa).
J. A. Lusher.
Water Science and Technology, Vol 14, No 9-11, p 1225-1237, 1982. 1 Fig, 6 Tab, 13 Ref.

Descriptors: *Water management, *Economic aspects, *Water pollution control, Water demand, *South Africa, Planning, Management, Decision making.

Water pollution control in South Africa is discussed from the point of view of cost and available sources of revenue. The complexities of interagency interpretation of the word pollution and assessment of the effects of water misuse, as well as how costs are to be borne out of available revenues, inevitably causes confusion in the public mind which is often, unfairly, attributed to bureacratic attitudes. The most that corporate and state responsibility can hope to achieve is to maintain environmental stress at a roughly constant level between technological epochs. The investment by the private sector of physical and human capital for the purposes of profit causes this stress. For this reason the control of pollution by price has been advocated. Water is far too cheap when it is noted that as a human necessity it is far too scarce. It is up to the state to redress the balance by coherent public policy. (Baker-FRC)
W83-02870

THEME 5: WATER POLLUTION CONTROL IN DEVELOPING COUNTRIES: REPORT OF THE SESSION CONVENOR,
Toronto Univ. (Ontario). Dept. of Civil Engineering.
P. H. Jones.
Water Science and Technology, Vol 14, No 9-11, p 1313-1318, 1982.

Descriptors: *Water pollution control, *Water management, *Developing countries, Drinking water, Water supply, Civil engineering.

In order to control water pollution in developing countries it is necessary for the governments of those countries to appoint a water board having responsibility for managing both the water supply and sanitation programs. These countries must also introduce environmental assessment legislation to carefully monitor the introduction of new industries, new developments, and extensions of existing developments including the water supply and sanitation programs themselves, and to evaluate the impacts of these on the environment. These countries must also consider the establishment of effluent standards to control the quality of discharges from new industries and municipal systems, develop a program of training professionals, paraprofessionals and technicians, as well as provide training for decision makers to guide the planning and policy making process. A spectrum of training must be maintained from the trade school level right through to the University level. Various methods must be developed to provide such serv-

ices to deal with the varifying needs of both the scattered communities with little or no organization and the central, congested slums of big cities. (Baker-FRC)
W83-02873

6G. Ecologic Impact Of Water Development

CHANGES IN ABUNDANCE AND GROWTH CHARACTERISTICS OF WHITE PERCH FROM THE MOUTH OF THE BAY OF QUINTE,
Ontario Hydro, Toronto. Research Div.
G. T. Haymes, W. E. Dunford, and G. L. Vascotto.
Journal of Great Lakes Research, Vol 8, No 4, p 614-618, 1982. 4 Fig, 1 Tab, 14 Ref.

Descriptors: *Fish harvest, *Environmental effects, *Lake fisheries, *Perch, Fish populations, Fisheries, Bay of Quinte, *Lake Ontario, Commercial fishing, Fishing, Lee's phenomenon, Fish growth, Lennox Generating Station, Powerplants.

White perch populations were sampled in April to November, 1972 through 1978, at three locations near the Lennox Generating Station in the Bay of Quinte. Average approximate monthly catches per 1.2 m trap net for May-July (months of largest catches) were: 175 in 1972, 258 in 1973, 130 in 1974, 155 in 1975, 45 in 1976, 8 in 1977, and < 1 in 1978. Annual commercial catches reached peaks in the range of 200,000-230,000 kg in 1965, 1972, 1976, and 1978. Between these peak periods annual commercial catches were in the 50,000-100,000 kg range. In 1979 the catch dropped sharply to 30,000 kg. Reasons for the low 1979 catch may be a reduction in the total number of gill nets set; the concentration of white perch in the Bay of Quinte mouth in winter, which facilitated commercial netting; and impingement of perch by the generating station intakes starting in 1975. There was a tendency for back-calculated fish lengths at a given age to become progressively smaller as the age of the fish from which they were computed increases (Lee's phenomenon). This may be a result of selective removal of faster growing individuals by commercial fishing. (Cassar-FRC)
W83-02808

INSTREAM FLOW REQUIREMENTS OF NATIVE CALIFORNIA STREAM FISHES,
California Univ., Davis. Dept. of Wildlife and Fisheries Biology.
P. B. Moyle, D. M. Baltz, and N. J. Knight.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-196683, Price codes: A03 in paper copy, A01 in microfiche. California Water Resources Center Completion Report, Univ. of California, Davis, April 1983. 24 p, 12 Tab, 6 Ref. OWRT B-210-CAL(1).

Descriptors: *Instream flow, *Fish, Trout, Roach, Sculpin, Sucker, Perch, Velocity, Temperature, Water depth, Temperature effects, Streamflow, Streams, *California, *Fish habitats.

Summaries are presented for two years of microhabitat studies on ten species of California stream fishes: rainbow trout, brown trout, speckled dace, California roach, hardhead, Sacramento squawfish, Lahontan redside, Sacramento sucker, Tahoe sucker, riffle sculpin, Paiute sculpin and tule perch. The measurements of velocity, depth and substrate associated with each species can be used to construct habitat use curves useful for small streams in the Sacramento Valley and in the Truckee drainage. It was found, however, that interactions among species can change microhabitat utilization and that each species has its own set of requirements which may differ somewhat between streams, reflecting both differences in the physical environment and differences in the composition of the fish community. It was also found that temperature has a significant effect on microhabitat utilization. As a consequence of temperature effects, species interactions and unpredictable fluctuations in flow, the relationship between habitat availability and actual use by the fishes in not a strong one. These results imply that if instream flow recommendations are based on the requirements of just one species (usually rainbow trout in California), the populations of other species may change in unpredictable ways. Instream flow recommendations made using 'habitat preference curves' constructed from data collected outside the impact area may not give an accurate picture of the effects of the changed flow regime on rainbow trout or other species. (Snyder-California)
W83-02906

AN ECOLOGICAL STUDY OF OZARK STREAMS,
Missouri Univ.-Columbia. School of Forestry, Fisheries and Wildlife.
C. F. Rabeni.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-202366, Price codes: A05 in paper copy, A01 in microfiche. Water Resources Research Center Completion Report, Univ. of Missouri, Columbia, March 1983. 81 p, 6 Fig, 6 Tab, 26 Ref, 3 Append. OWRT A-131-MO(1), 14-34-0001-1127 and 2127.

Descriptors: *Streams, *Population dynamics, Secondary production habitat, Ambloplites rupestris, Micropterus dolomieui, Orconectes, Interspecific interactions, Competition, Missouri, Current River, Jacks Fork River, Ecological impact, *Crayfish, Environmental studies.

This research was aimed at quantifying the main pathways of energy flow through an Ozark springfed stream. Crayfish (Orconectes spp.) were shown to be the most important invertebrate group in the use of the primary food resources. In turn, crayfish provided the majority of energy for the top predators of the streams: the rock bass (Ambloplites rupestris) and the smallmouth bass (Micropterus dolomieui). The focus was on examining the links among species of crayfish and fish: how they partition their energy supply and their habitat to achieve coexistence. Field sampling and laboratory experiments determined that coexistence of crayfish species was size related and this mechanism for allowing sympatry increased the overall secondary production of the stream. We investigated the mechanisms of rock bass-smallmouth bass interactions with each other and with their food base was investigated. It was concluded that the two species coexist by sharing the abundant food base and partitioning available habitat.
W83-02916

METABOLISM OF CALIFORNIA STREAM FISHES,
California Univ., Davis. Dept. of Wildlife and Fisheries Biology.
For primary bibliographic entry see Field 5C.
W83-02944

HYDROLOGIC CHARACTERISTICS OF SURFACE-MINED LAND RECLAIMED BY SLUDGE IRRIGATION, FULTON COUNTY, ILLINOIS,
Geological Survey, Urbana, IL. Water Resources Div.
For primary bibliographic entry see Field 5A.
W83-02975

METHODOLOGY FOR HYDROLOGIC EVALUATION OF A POTENTIAL SURFACE MINE: LOBLOLLY BRANCH BASIN, TUSCALOOSA COUNTY, ALABAMA,
Geological Survey, Denver, CO. Water Resources Div.
L. M. Shown, D. G. Frickel, R. F. Miller, and F. A. Branson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-238361, Price codes: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 82-50, 1982. 93 p, 12 Fig, 16 Tab, 70 Ref.

Descriptors: *Estimating equations, *Evaluation, *Coal mining, *Land reclamation, Surface water, Groundwater, Water quality, Vegatation, Soil water, Soil porosity, Flow characteristics, Flood peak, Detention reservoirs, Sediment yield, *Alabama, Tuscaloosa County, Warrior Coal Field.

Methodology for evaluation of premining hydrology and postmining effects and reclamation on the hydrology of an area is presented for a potential mine site in northwestern Alabama. Estimation techniques and extrapolation are used to develop data for reconstructed topography, soil-water relations, peak flows, flow volumes, soil losses, and sediment yields. Streamflow response of the basin is described by the variable-source-area concept; nearly all water flows through coarse-textured soils and unconsolidated sand and gravel deposits that are underlain by an impermeable clay zone. The resultant peak discharges are small to moderate, and there is very little erosion of slopes or channels. Susceptibility of the soils to compaction by heavy machines and the effects of compaction on soil-water relations are demonstrated. Estimates of peak discharges made with four methods are divergent, particularly for recurrence intervals of 2, 5, and 10 years; divergence is less for 25-, 50-, and 100-year discharges. A premining estimate of sediment yield made with the Universal Soil Loss Equation and sediment-delivery ratio is about 2.5 times larger than an estimate made with the sediment rating curve-flow duration method. (USGS)
W83-02976

AQUATIC BIOLOGY IN NEDERLO CREEK, SOUTHWESTERN WISCONSIN,
Geological Survey, Madison, WI. Water Resources Div.
P. A. Kammerer, Jr, R. A. Lidwin, J. W. Mason, and R. P. Narf.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-257577, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 82-56, November 1982. 27 p, 6 Fig, 10 Tab, 20 Ref.

Descriptors: *Small watersheds, *Water quality, *Ecosytems, *Aquatic life, Benthic fauna, Aquatic plants, Algae, Aquatic insects, Trout, Spawning, Aquatic environment, *Wisconsin, Nederlo Creek, Driftless area.

This report presents the results of biological investigations made during a study of hydrology and water quality in a small drainage basin in the 'Driftless Area' of southwest Wisconsin. The aquatic community is diverse and reasonably stable with little indication of environmental disturbance. Aquatic macrophyte population (dominated by Ranunculus aquatilis L., Veronica catenata Penn., and Nasturtium officinale) varies little from spring to fall. Periphytic and planktonic algae are predominantly diatoms, with the genus Achnanthes dominating both communities. Most genera of planktonic algae originate in the periphyton, but some true planktonic algae were identified. The benthic invertebrate population is dominated by Trichoptera. Biotic index values calculated from benthic invertebrate data indicate that water quality is very good to excellent. The trout population is low and represents only a small part of the total fish population both in biomass and numbers. The most important environmental factors limiting trout population appear to be lack of sufficient cover, insufficient pool depth and volume, and limited spawning areas. The wild trout population is highly dependent on spawning success; when spawning success was poor, populations the following fall were extremely low. (USGS)
W83-02978

EFFECTS OF A FLOODWATER-RETARDING STRUCTURE ON THE HYDROLOGY AND ECOLOGY OF TROUT CREEK IN SOUTHWESTERN WISCONSIN.
Geological Survey, Madison, WI. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161. Geological Survey Water-Resources Investigations 82-23, August 1982. 68 p, 35 Fig, 27 Tab, 67 Ref. (Wentz, D. A., and Graczyk, D. J., Editors).

Descriptors: *Stream discharge, *Floodwater, *Ecology, *Detention reservoirs, Streamflow,

Flood peak, Channel morphology, Bed load, Sedimentation, Trap efficiency, Sediment transport, Sediment yield, Bankfull stage, Flood flow, Channel morphology, Hydraulic geometry, Trout, Aquatic insects, *Wisconsin, Trout Creek, Floodwater-retarding structure.

The primary effect of a floodwater-retarding structure (FRS) on the flow of Trout Creek, Wisconsin is attenuation of flood peaks. Reduction of flood peaks ranged from 58 to 91% during the study period, 1975 to 1979. An inverse relationship exists between sediment concentration and outflow from the FRS during floods. Most sediment stored in the flood pool during floods is released from the reservoir during subsequent reduced discharge. Sediment-trapping efficiency of the FRS was 7% during the 4-year study. The bankfull capacity of the channel was reduced from 154 cubic feet per second upstream from the FRS to 65 cubic feet per second downstream. Mean bankfull depth downstream from the FRS has adjusted to a value 45% less than upstream from the structure due to the sedimentation of materials transported from the FRS during reduced flows. The FRS was not found to have any significant adverse effect on the arthropod fauna or trout reproduction in Trout Creek from 1975 to 1979. During 1960-1979, winter floods seem to have had the greatest adverse effect on the survival of brown trout eggs and sac fry. (USGS)
W83-02985

PRELIMINARY PROJECTIONS OF THE EFFECTS OF CHLORIDE-CONTROL STRUCTURES ON THE QUATERNARY AQUIFER AT GREAT SALT PLAINS, OKLAHOMA,
Geological Survey, Oklahoma City, OK. Water Resources Div.
For primary bibliographic entry see Field 5G.
W83-02988

BIOLOGICAL AND RECREATIONAL ASPECTS OF WATER LEVEL MANAGEMENT FOR CLEAR LAKE, IOWA,
Iowa State Univ., Ames. Dept. of Animal Ecology.
W. A. Hubert, J. G. Nickum, D. L. Stang, D. D. McLean, and P. E. Niemeir.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-206839, Price codes: A07 in paper copy, A01 in microfiche. Iowa State Water Resources Research Institute Report No 132, January 1983. 139 p, 14 Fig, 42 Tab, 116 Ref. OWRT B-070-IA(1), 14-34-0001-1226.

Descriptors: *Lake, Fish, *Water level stabilization, Fluctuation, Management, *Recreation, *Iowa, Clear Lake, *Aquatic plants, Literature reviews, Surveys.

A literature review and field study were conducted to determine the influence of water level stabilization on biological and recreational aspects of a shallow lake. The aquatic plant community was dominated by emergent species that would be adversely influenced by water level stabilization. The fish community has been influenced by introduction of exotic species and by winterkill. Several species found in Clear Lake have strong habitat associations with aquatic plants. While there is evidence that the elimination of aquatic plants would effect the fish community, it is not possible to predict the manner in which the fish community might change as a result of water level stabilization or reduction in abundance of littoral plants. Recreationists preferred water level stabilization, but it was unlikely that their current perceptions included an understanding of potential impacts on the plant community.
W83-03036

BEHAVIOR OF FISHES IN THE DESAULNIERS RIVER BASIN AFTER FILLING OF THE DESAULNIERS RESERVOIR (COMPORTEMENT DES POISSONS DU BASSIN DE LA RIVIERE DESAULNIERS APRES LE REMPLISSAGE DU RESERVOIR DESAULNIERS),
R. Boucher.
Canadian Water Resources Journal, Vol 7, No 1, p 215-228, 1982. 6 Fig, 12 Ref.

Descriptors: *Fish, *Reservoirs, *Deoxygenation, Water quality, Desaulniers reservoir, James Bay, Lake Desaulniers, Fisheries, Desaulniers river, Fisheries management, Environmental effects, *Canada.

Fish were captured with mesh nets in the lakes and with hoop nets in the rivers feeding into the Desaulniers Reservoir. Before impoundment of the reservoir most of the movements of the fish had been related to spawning. During the first two years of impoundment, the brook trout left the reservoir with the deoxygenation of the water and went upstream, toward the Desaulniers Rivers. The white suckers left the reservoir for the same reason, but moved toward Lake Desaulniers. During the reoxygenation periods the species generally return to the reservoir. During the same years, the small fish (sticklebacks, yellow perches, trout-perches, sculpins) from Lake Desaulniers and the Desaulniers River invaded the reservoir. After these migrations, brook trout changed their feeding habits. An improvement was noted in growth. (Baker-FRC)
W83-03050

ECONOMIC AND ENVIRONMENTAL ISSUES OF THE PROPOSED EXTENSION OF THE WINTER NAVIGATION SEASON AND IMPROVEMENTS ON THE GREAT LAKES-ST. LAWRENCE SEAWAY SYSTEM,
Canada Centre for Inland Waters, Burlington (Ontario).
A. J. Niimi.
Journal of Great Lakes Research, Vol 8, No 3, p 532-549, 1982. 1 Fig, 4 Tab, 41 Ref.

Descriptors: *Environmental effects, *Ice, Cost-benefit analysis, *Great Lakes, *St. Lawrence Seaway, *Canada, Navigation, Wetlands, Economic aspects, Benefits, International agreements.

An expansion of navigation activity on the Great Lakes-St. Lawrence Seaway would not be in the best interest of Canada, according to a study of the cost-benefits and environmental impacts of the project. A 1979 report by the U.S. Army Corps of Engineers proposed extension of the existing 8.5 month navigation season to 11-12 months and/or upgrading facilities to accommodate larger vessels. Total costs of the proposed improvements are difficult to establish. Various government groups and interest groups have produced different economic evaluations. Environmental costs and benefits, such as loss of hydroelectric generating capacity, have not been properly assessed. Some of the expected negative effects associated with navigation during the ice-covered season and with ice control measures are water temperature profile changes, disruption of fish movements, increased turbidity, destruction of ice crossings for large mammals, closing of open-water leads used for feeding and resting by water birds, increased shoreline erosion, and water level fluctuations. Most of the major capital improvements and the environmentally sensitive areas are within Canadian waters. (Cassar-FRC)
W83-03072

STREAM TEMPERATURE UNDER AN INADEQUATE BUFFER STRIP IN THE SOUTHEAST PIEDMONT,
Georgia Univ., Athens. School of Forest Resources.
J. D. Hewlett, and J. C. Fortson.
Water Resources Bulletin, Vol 18, No 6, p 983-988, December, 1982. 5 Fig, 9 Ref.

Descriptors: *Forest watersheds, *Logging, *Water temperature, Buffer zones, Clear-cutting, Forest management, Temperature, Stream degradation, Piedmont, Putnam County, *Georgia, Environmental effects, Watershed management.

The effects of clearcutting loblolly pine on stream water quality were determined in a paired watershed study in Putnam County, Georgia. The control watershed was left in its original state, while the logged area had a partial and irregular buffer strip of 20 ft covering each bank for about 50% of its total length. Water temperatures in the logged watershed in summer were as much as 20 F higher than the control; minimum temperatures in winter were 10 F lower than the control. These observed results did not agree with results from Brown's stream temperature model, which predicted much smaller temperature variations. Results suggest that in areas of gentle land relief even a substantial buffer strip may be insufficient to preserve lower temperatures in shallow groundwater moving toward the stream. (Cassar-FRC)
W83-03149

7. RESOURCES DATA

7A. Network Design

UTILIZATION OF COMPUTERIZED WATER MONITORING AND INFORMATION SYSTEM,
Bayerisches Landesamt fuer Wasserwirtschaft, Munich (Germany, F.R.).
E. Ottmann.
Water Science and Technology, Vol 14, No 9-11, p 1540-1544, 1982. 4 Fig.

Descriptors: *Water quality control, *Monitoring, *Computers, Bavaria, Hydrology, Data collection, Stream flow, Data processing, Telemetry, *Federal Republic of Germany.

Computerized water monitoring and information systems may serve several purposes: provide information for special tasks such as modelling prediction of various operations, monitor conditions on overloaded rivers, or inspect the performance of treatment plants and compare this performance with the requirements of state or national laws. The resulting benefits in operation should be set against the costs of installation and the advantage of continuous measurement of parameters. The monitoring network built in Bavaria during the last five years uses a computerized information system that collects data from widely scattered points on rivers and offers evaluated information for users. Control of the automated system is carried out regularly by process computer connected to field stations in Bavaria via dial link lines of the public telephone network and with special parallel-serial codes. Reverse communication is available for remote controlling. (Baker-FRC)
W83-02883

WATER-DATA PROGRAM OF THE U.S. GEOLOGICAL SURVEY,
Geological Survey, Reston, VA. Water Resources Div.
B. K. Gilbert, and T. J. Buchanan.
Available from the Br. of Distr., USGS, 604 S. Pickett St. Alexandria, VA 22304. Geological Survey Circular 863, 1982. 16 p, 6 Fig, 11 Ref.

Descriptors: *Hydrologic data, *Data aquisition, *Data storage and retrieval, Data transmission, Network design, Groundwater, Surface water, Water quality, *U.S. Geological Survey, Quality assurance.

The U.S. Geological Survey is the principal Federal agency responsible for the collection of hydrologic data needed for the planning, development, use, and management of the Nation's water resources. These data are the foundation necessary for conducting analytical and interpretive appraisals describing the occurrence and availability of surface and ground waters, and their physical, chemical, and biological characteristics. The data are likewise required for basic and problem-oriented research in hydraulics, hydrology, and related fields. Hydrologic data collection by the Geological Survey began in 1894. Current operations include about 17,000 stations for collection of river, lake, and reservoir data; about 27,000 wells for collection of ground-water data; and almost 17,000 stations for collection of water-quality information. These activities are described as well as the means by which the data are made available, and how the

program is coordinated with other agencies. (USGS)
W83-02967

DESIGN OF SURFACE-WATER DATA NETWORKS FOR REGIONAL INFORMATION,
Geological Survey, Reston, VA. Water Resources Div.
M. E. Moss, E. J. Gilroy, G. D. Tasker, and M. R. Karlinger.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $4.50. Geological Survey Water-Supply Paper 2178, 1982. 33 p, 12 Fig, 1 Tab, 22 Ref.

Descriptors: *Surface water, *Network design, *Hydrologic data, Regional analysis, Regression analysis, Data collections, Computer programs.

This report describes a technique, Network Analysis of Regional Information (NARI), and the existing computer procedures that have been developed for the specification of the regional information versus cost relation for several statistical parameters of streamflow. The measure of information used is the true standard error of estimate of a regional logarithmic regression. The cost is a function of the number of stations at which hydrologic data are collected and the number of years for which the data is collected. The technique can be used to obtain on a probability basis either (1) a minimum cost network that will attain a prespecified accuracy and reliability or (2) a network that maximizes information given a set of budgetary and time constraints. (USGS)
W83-02970

WATER RESOURCES AND DATA-NETWORK ASSESSMENT OF THE MANASOTA BASIN, MANATEE AND SARASOTA COUNTIES, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
D. P. Brown.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-156653, Price codes: A05 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 82-37, 1982. 80 p, 35 Fig, 10 Tab, 111 Ref.

Descriptors: *Data collections, *Network design, *Water resources development, *Water use, Rainfall, Streamflow, Surface water, Water quality, Groundwater, Aquifers, *Florida, Manasota basin, Manatee County, Sarasota County.

The average annual rainfall in the Manasota Basin is 53.7 inches, and annual evapotranspiration is about 39 inches. Annual runoff from gaged parts of the Basin ranges from about 13 to 17 inches per year. Streamflow in the upland areas diminishes rapidly following the end of the rainy season and approaches zero during extended dry periods. Generally, surface water is of good quality except in tidally affected, coastal areas. Its quality varies seasonally, generally becoming more mineralized during the dry season. The principal hydrogeologic units are the surficial aquifer, the upper confining beds and minor artesian aquifers, the Floridan acquifer, and the lower confining bed. The quality of ground water is generally good except in the western and southern parts where saltwater intrusion or incomplete flushing of residual seawater has occurred. Land-use changes and stream impoundments and diversions require reassessment of the type and use of data collected by the surface-water network. Such changes may require modification of existing sites and establishment of new ones. Development and completion of the monitoring plan could provide most of the data necessary to define the groundwater system. (USGS)
W83-02973

MODERN INFORMATION SYSTEMS FOR WATER SUPPLY COMPANIES-REQUIREMENTS AND FUNCTIONS (MODERNE INFORMATIONSSYSTEME FUR WASSERWARTEN - ANFORDERUNGEN UND FUNKTIONEN),
Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e.V., Karlsruhe (Germany, F.R.). Inst. fuer Informations- und Datenverarbeitung.
J. Busser, and H. Lindenberg.
Gas- und Wasserfach: Wasser/Abwasser, Vol 122, No 8, p 351-356, 1981. 6 Fig, 1 Ref.

Descriptors: *Automation, *Water conveyance, *Computers, Water management, Municipal water, Data processing, Water quality data, Hydrologic data, Water supply systems.

The use of small computers and microprocessing units together with standardized software can make computer-controlled operation systems economically practical for small- and medium-sized water supply companies. Basic hardware and software requirements needed for the implementation of a simple system operation, an operational modification and extension service available after the start of operation, and a maintenance service which may be performed in most cases by non-specialists are described. The system, designed especially for companies inexperienced in computer technology, is based on clearly arranged presentation of messages, analog signals, numerical signals, and calculations in alphanumerical and graphical form on displays and printers, as well as comfortable conversational modes. (Author's abstract)
W83-03058

7B. Data Acquisition

CALIBRATION AND FIELD TESTING OF A TWO-PROBE GAMMA GAUGE,
Hebrew Univ., Rehovoth (Israel). Dept. of Soil and Water Sciences.
E. Rawitz, H. Etkin, and A. Hazan.
Soil Science Society of America Journal, Vol 46, No 3, p 461-465, May/June, 1982. 2 Fig, 6 Tab, 10 Ref.

Descriptors: *Soil density, *Calibrations, *Measuring instruments, Density, Soil moisture, *Gamma probe.

A commercial double probe gamma gage for measuring soil moisture and bulk density was calibrated in the laboratory and in field tests in sandy loam loess soils in the Negev region. Laboratory tests showed that the transmitted count rate was affected by the extent of the medium surrounding the beam path, indicating that linearity between log of count rate and sample density is not sufficient proof of monochromatic radiation. It was necessary to use separate attenuation coefficients for soil solids and water. The universal calibration equation for wet density should be used. The calibration stand supplied with the instrument did not produce a calibration curve adequate for field work. Determination of a multipoint calibration curve in the field is necessary. With proper calibration, the gamma probe was able to determine soil density with satisfactory reliability. (Cassar-FRC)
W83-02964

COMPUTER-LINKED CCD CAMERA FOR SEDIMENT SHAPE ANALYSIS,
Idaho Univ., Moscow. Coll. of Mines and Earth Resources.
K. A. Prisbrey, R. E. Rinker, and M. B. Aboukheshem.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-208918, Price codes: A03 in paper copy, A01 in microfiche. Idaho Water and Energy Resources Research Institute Completion Report, Moscow, March 1983, 28 p, 5 Fig, 2 Tab, 12 Ref, 1 Append. OWRT A-081-IDA(1), 14-34-0001-0216.

Descriptors: *Image processing, Data collection, *Computer Fourier analysis, *Data acquisition, *Camera interfacing, Data interpretation, Sediment shape analysis.

A major problem with using chemical and mineralogical composition analysis to trace stream sediment origins is the cost. A solution to this problem is to use Fourier shape descriptors of individual sediment particles, which gives an inexpensive means of distinguishing sediments even with similar chemical and mineralogical characteristics. A CCD camera was linked to a PDP 11 computer to provide a rapid method of data gathering for such analysis.
W83-03111

SOIL MOISTURE VARIATION PATTERNS OBSERVED IN HAND COUNTY, SOUTH DAKOTA,
National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center.
For primary bibliographic entry see Field 2G.
W83-03138

7C. Evaluation, Processing and Publication

PACKAGING OF INFORMATION- PART AND PARCEL OF SUCCESSFUL TECHNOLOGY TRANSFER,
Water Research Commission, Pretoria (South Africa).
M. J. Pieterse.
Water Science and Technology, Vol 14, No 9-11, p 1289-1298, 1982. 23 Ref.

Descriptors: *Technology transfer, *Information exchange, Information systems, Data collections.

For successful technology transfer to occur, the correct packaging of information is needed. Research findings should be tailored and packaged in a format and language that is understandable and acceptable to the user. The transfer should be directed at a target audience, and the principle in the transfer process is simplicity. Various packaging techniques are described; these include mass media techniques such as seminars, conferences, demonstrations and education. The important role of personal contact in a technology transfer program is also stressed. Terminology regarding technology and information transfer is briefly discussed. The availability of the relevant information and the important role of the technology transfer specialist are also briefly examined. (Baker-FRC)
W83-02859

GEOLOGIC AND WELL-CONSTRUCTION DATA FOR THE H-7 BOREHOLE COMPLEX NEAR THE PROPOSED WASTE ISOLATION PILOT PLANT SITE, SOUTHEASTERN NEW MEXICO,
Fenix and Scisson, Inc., Tulsa, OK.
For primary bibliographic entry see Field 4B.
W83-02977

TECHNIQUES FOR ESTIMATING FLOOD DISCHARGES FOR UNREGULATED STREAMS IN NEW MEXICO,
Geological Survey, Albuquerque, NM. Water Resources Div.
For primary bibliographic entry see Field 2E.
W83-02981

FLOODS IN MAINE, APRIL-MAY 1979,
Geological Survey, Augusta, ME. Water Resources Div.
For primary bibliographic entry see Field 2E.
W83-02983

HYDROLOGIC DATA OF THE LAKE COCHITUATE DRAINAGE BASIN, FRAMINGHAM-NATICK, MASSACHUSETTS,
Geological Survey, Boston, MA. Water Resources Div.
F. B. Gay.
Massachusetts Hydrologic-Data Report No 23, 1981. 61 p, 1 Fig, 1 plate, 16 Tab, 15 Ref.

Descriptors: *Hydrologic data, *Surface runoff, *Nitrogen cycle, *Phosphorus compounds, Potentiometric level, Observation wells, Lakes, Water quality, Groundwater movement, Insecticides, Heavy metals, Chemistry of precipitation, *Massachusetts, Lake Cochituate drainage basin.

This report presents, in tabular form, hydrologic data on the 17.7-square-mile drainage basin above the outlet of Lake Cochituate including parts of Ashland, Framingham, Natick, Sherborn, and Wayland, Massachusetts. These data were collected from July 1977 to July 1979 by the U.S. Geological Survey during a study to describe the inflow and outflow of nutrients in Lake Cochituate. Information in this report includes daily mean discharges and nutrient concentrations for Beaverdam, Course, Pegan, and Snake Brooks (principal streams discharging to Lake Cochituate), and the outlet of Lake Cochituate. It includes instantaneous discharges and nutrient concentrations at 17 storm sewers discharging directly into Lake Cochituate during three rainstorms as well as nutrient concentrations of the wet-atmospheric deposition. It also includes monthly water-level measurements and nutrient concentrations of water from 29 observation wells around Lake Cochituate, selected information on 87 wells and borings, and particle-size distribution of 30 lithologic samples. Many chemical analyses of other constituents associated with the nutrients are also tabulated in this release. (USGS)
W83-02989

HYDROLOGIC DATA OF THE LOWER MERRIMACK RIVER BASIN, MASSACHUSETTS, FROM CONCORD RIVER, LOWELL, TO PLUM ISLAND, NEWBURYPORT,
Geological Survey, Boston, MA. Water Resources Div.
D. F. Delaney, and F. B. Gay.
Massachusetts Hydrologic-Data Report No 24, 1981. 34 p, 1 Plate, 5 Tab, 25 Ref.

Descriptors: *Hydrologic data, *Groundwater, *Text wells, Well longs, Water level, Water table, Chemical analysis, Water quality, *Massachusetts, Lower Merrimack River basin, Borings.

Hydrologic information contained in this report includes physical descriptions of 743 wells, test wells, and borings; logs of materials for 554 of these wells and borings; chemical analysis of water from 51 of these wells compiled from 1972 to 1974; and a list of publications containing water-level records. These data are for all or parts of the cities and towns of Amesbury, Andover, Boxford, Dracut, Groveland, Haverhill, Lawrence, Merrimac, Methuen, Newbury, Newburyport, North Andover, Salisbury, Tewksbury, and West Newbury in Essex and Middlesex Counties. These municipalities are in the lower Merrimack River basin, which drains approximately 180 square miles along the New Hampshire border in northeastern Massachusetts. This area includes parts of the Merrimack River basin within Massachusetts east of the Beaver Brook and Concord River basins except for the Shawsheen River basin. Even though the Blackwater River basin within Massachusetts isn't part of the lower Merrimack River basin, it has been included in this report. (USGS)
W83-02994

DATA FILTERING FOR LARGE AREA ANALYSIS-AN EXAMPLE FROM THE CANADIAN NEARSHORE ZONE OF THE GREAT LAKES,
Canada Centre for Inland Waters, Burlington (Ontario).
D. J. Gregor, and E. D. Ongley.
Journal of Great Lakes Research, Vol 8, No 3, p 470-481, 1982. 3 Fig, 2 Tab, 18 Ref.

Descriptors: *Lakes, *Data collections, *Great lakes, Water quality, Spatial distribution, Monitoring, Temporal distribution, Data processing.

A straightforward analysis of the data base compatible with other studies devoted to the assessment of historical Great Lakes basin data is presented. Such a great amount of data is available on the subject that a methodology has been developed to reduce the data set to a manageable size and provide a substantive summary of nearshore water quality for the period 1967-1973. Initially the data can be divided temporally to reflect major changes in laboratory techniques and sampling methodology. Subsequently, the data base is partitioned into geographical regions reflecting sampling station configurations and subjective criteria regarding expected homogeneous water quality. Surface and subsurface data are distinguished among limnologically defined seasons. Descriptive statistics are generated for each cell of the timeframe matrix. One and two-way analysis of variance techniques are used to determine significant statistics for each timeframe matrix. These are assumed to be conservative estimates of average water quality for a given parameter within a particular region and for specified time periods and depths or combinations thereof. Selected water quality data are presented to demonstrate the ability of the method to provide periods of record composite comparisons among water bodies, spatial comparisons within any one time frame and for any selected cell, and temporal trends determined by weighted linear regression for a selected cell through the three timeframes. It was concluded that this data base is useful for evaluating broad spatial and temporal trends and assessing the effect of remedial programs, and warrants more comprehensive anlaysis in conjunction with loadings information and open lake data. (Baker-FRC)
W83-03085

COMPARING METHODS OF HYDROLOGIC REGIONALIZATION,
Geological Survey, Reston, VA.
G. D. Tasker.
Water Resources Bulletin, Vol 18, No 6, p 965-970, December, 1982. 1 Fig, 2 Tab, 16 Ref.

Descriptors: *Regional analysis, *Regression analysis, *Model studies, Hydrologic models, Cluster analysis, Data splitting, *Arizona, Gaging stations, Rainfall-runoff relationships.

Data splitting is used to compare methods of determining 'homogeneous' hydrologic regions. The methods compared use cluster analysis based on similarity of hydrologic characteristics or similarity of characteristics of a stream's drainage basin. Data for 221 stations in Arizona are used to show that the methods, which are a modification of DeCoursey's scheme for defining regions, improve the fit of estimation data to the model, but that it is necessary to have an independent measure of predictive accuracy, such as that provided by data splitting, to demonstrate improved predictive accuracy. The methods used the complete linkage algorithm for cluster analysis and computed weighted average estimates of hydrologic characteristics at ungaged sites. (Author's abstract)
W83-03146

AN ENVIRONMENTAL QUALITY INDEX FOR THE GREAT LAKES,
Wisconsin Univ.-Madison. Water Resources Center.
C. E. Steinhart, L. J. Schierow, and W. C. Sonzogni.
Water Resources Bulletin, Vol 18, No 6, p 1025-1031, December, 1982. 1 Fig, 5 Tab, 23 Ref.

Descriptors: *Water quality, *Environmental quality, Lakes, *Great Lakes, Evaluation, Lake restoration.

A new index for summarizing environmental quality was developed for the nearshore waters of the Great Lakes. The index is based on nine physical (P), chemical (C), biological (B), and toxic substance (T) variables. Raw data are converted to subindex values by mathematically defined functions based on national and international objectives. The subindex values are multiplied by weighting factors and addition to give a total score of zero (worst quality) to 100 (highest quality). Subscripts next to the index letters indicate how many of each type of variable were worse than the objectives. For 18 locations in the Great Lakes the index scores ranged from 98 at two stations in Lake Superior to 30 C2P1B2T3 at Point Mouille, Lake Erie. This score is interpreted as: a quality of 30 with deficiencies in 2 chemical, 1 physical, 2 biological, and 3 toxic substance variable. (Cassar-FRC)
W83-03148

8. ENGINEERING WORKS

8A. Structures

RESERVOIR CAPACITY CONSERVATION (CONSERVAZIONE DELLA CAPACITA UTILE NEI LAGHI ARTIFICIALI),
Parma Univ. (Italy).
E. Roveri.
Wasser, Energie, Luft, Vol 73, No 9, p 199-201, September, 1981. 4 Fig, 1 Tab. English summary.

Descriptors: *Artificial lakes, *Reservoir operation, *Sediment discharge, Pipelines, Reservoir silting, Mud, Rendina Lake, *Italy.

The availability of water continues to be a major world-wide problem. Industry and agriculture require increasing amounts of water at low cost, which can only be obtained through the use of artificial reservoirs. However, these reservoirs tend to have a limited lifetime as a result of the suspended solid material carried into them by a streams. The results of application of a new method for cleaning and maintaining reservoirs to artificial lakes in Italy are discussed. The technique involves the use of underwater pipelines to carry the sediments away from the lake. It is possible to control and correct the density and fluidity of the sediments in order to attain a high output without causing detrimental sedimentation downstream. In experiments at Rendina lake in southern Italy, sediments containing a high percentage of sand and clay solids nevertheless were rendered fluid enough to flow easily along the canal downstream from the dam. The primary advantages of the new process are the ability to remove mud quickly, the possibility of using the process on the filled lake, and the ability to disperse the mud downstream. (Carroll-FRC)
W83-02953

SIGNIFICANCE ON THE NEW LARGE WATER RESERVOIR SCHONBUHL AND ITS CONSEQUENCES ON THE LANDESWASSERVERSORGUNG STUTTGART (DIE BEDEUTUNG DES NEUEN GROSSBEHALTERS SCHONBUHL FUR DIE LANDESWASSERVERSORGUNG STUTTGART),
Zweckverband Landeswasserversorgung, Stuttgart (Germany, F.R.).
D. Flinspach.
Wasserwirtschaft, Vol 71, No 3, p 69-73, March, 1981. 6 Fig, 2 Tab, 6 Ref. English summary.

Descriptors: *Water storage, *Reservoir storage, Electric power production, Hydraulic design, Reservoir construction, Reservoir design, Water conveyance, Stuttgart, *Federal Republic of Germany.

The water supply organization 'Landeswasserversorgung Stuttgart,' in West Germany, is constructing a large water storage reservoir with a capacity of 88,000 cubic meters, which is situated 15 kilometers east of Stuttgart. The location of this storage reservoir at the intersection of the three water mains serving an extensive area, its proximity to the main center of consumption, and its size offer novel possibilities for the operation of the long distance water supply system. Efforts of the system's management to maximize procurement, transport, and distribution of water supplies are discussed. Both the construction and the hydraulic lay-out of the reservoir are described. The water storage reservoir will also be connected to an installation for the generation of electric power, which will, together with other such facilities already in operation, enable the Landeswasserversorgung Stuttgart to improve the cost-benefit relationship for electric power. (Author's abstract)
W83-02963

THE FUTURE OF UNDERGROUND PUMPED HYDRO.
International Water Power and Dam Construction, Vol 34, No 12, p 73-75, December, 1982. 2 Fig.

Descriptors: *Pumped storage, *Underground structures, *Hydroelectric plants, Turbines, Pump turbines, Powerplants, Water storage, Reservoirs.

Underground pumped hydro storage (UPH) will become more feasible as soon as reversible pump turbines are developed for operation at 1000-1500 m heads. UPH can be used in flat topography and has minimum environmental impact because one reservoir and the powerhouse are underground. High heads are necessary to minimize the volume of the underground excavation. Disadvantages are the relatively high minimum economic installed capacity (1200-1500 MW), long construction schedule, and high capital costs. A two-stage arrangement is proposed to take advantage of existing turbines. For the Netherlands a design combining UPH with wind power is under study. These findings and other papers were presented at the International Conference on Underground Pumped Hydro and Compressed Air Energy Storage, September 20-22, 1982, San Francisco, California. (Cassar-FRC)
W83-03012

SMALL HYDRO NEEDS ITS OWN EXPERTS.
International Water Power and Dam Construction, Vol 34, No 12, p 69-71, December, 1982. 2 Fig, 3 Ref.

Descriptors: *Hydroelectric plants, *Design criteria, Powerplants, Specifications, Hydraulic structures, Turbines, Settling basins, Generators.

Mini hydro plants cannot be mass produced; each must be designed individually to suit the unique site and conditions. Reference material and experience for small-scale projects is scarce. As a result, poorly designed systems may cause disillusionment with small schemes in general. The intake, the most critical part of the design, must be designed to be easily cleaned or self-cleaned. The most successful settling basins use deep narrow channels, which may be cleaned by draining the pond and allowing the silt to leave through a bywash. Earth-lined canals or wooden flumes made of indigenous timber should always be considered before installing expensive concrete or steel pipes. Penstocks often have an excessive safety factor, which unnecessarily increases costs. Generators should match the turbine output at a head near that of the maximum normal head rather than the rated output. Specifications originally written for large vertical turbines cannot be simply scaled down to apply to small systems, which usually use horizontal turbines and simpler equipment. Specifications should not be unnessarily narrow, so that it will be possible to take advantage of manufacturers' standard items if these are economical. Many powerhouse features necessary in large installations can be eliminated for a small system. (Cassar-FRC)
W83-03013

8B. Hydraulics

SUPPRESSION OF DENSITY WAVES IN CLARIFIERS,
Waterloo Univ. (Ontario). Dept. of Chemical Engineering.
M. C. Murphy, R. R. Hudgins, and P. L. Silveston.
Water Science and Technology, Vol 14, No 9-11, p 1510-1513, 1982. 4 Fig, 3 Ref.

Descriptors: *Density waves, *Clarifiers, *Wastewater treatment, Model studies, Baffles, Fluid mechanics, Mechanical equipment.

Baffles designed to function as wave traps have been shown in experiments to suppress low-frequency, large-amplitude density waves. Experiments were conducted using a 122 cm diameter, circular clarifier with a 1:10 slope from the periphery to the center well. The vessel was dimensionally similar to a full scale center feed, horizontal flow circular clarifier. Simultaneous measurements of solids removal show substantial improvement. The relationship between density waves and the deviation from ideal clarifier performance that earlier papers on internal waves have suggested has been established in this work. The power spectrum of the internal waves and the effect of operating variables such as overflow rate, scraper speed, and suspended solid on the spectrum and solids removal are discussed. (Baker-FR)
W83-02880

TURBULENT VERTICAL MOMENTUM TRANSFER IN STRATIFIED ENVIRONMENTS,
Nevada Univ. System, Las Vegas. Desert Research Inst.
For primary bibliographic entry see Field 2E.
W83-02901

FAST-WATER STREAMS DEFLECTED BY TRANSVERSE WALLS,
University Coll., London (England). Dept. of Civil Engineering.
A. R. Bokaian.
Proceedings of the Institution of Civil Engineers. Part 2: Research and Theory, Vol 73, No 4, p 747-767, December, 1982. 10 Fig, 1 Tab, 22 Ref.

Descriptors: *Flow velocity, *Jets, *Spillways, Hydraulic structures, Hydraulic jump, Hydraulic properties, Flow pattern, Rapid flow, Waves, Supercritical flow, Turbulent flow, Water flow.

Experimental work was carried out to investigate the phenomena associated with a water jet of finite dimensions issuing from an overflow spillway and deflected by a smooth vertical transverse wall which is perpendicular to the initial flow direction. The state of development of the supercritical flow at the toe of the spillway was quasi-potential in most tests. Three disctinct regions of flow were identified. In Region 1, which began at the toe of the spillway, the water depth remained approximately constant apart from a region adjacent to the outlet where a degree of lateral discharge was observed. In Region 2, a hydraulic jump with a lateral discharge was observed. In Region 3, the flow separated from the bed and impinged violently on the wall and became entirely parallel to it, resulting in a complex wave pattern at the wall. Redirection of the flow along the channel center line in Regions 1 and 2 was found to be negligible. In Region 1, the mean flow characteristics were studied in a form relevant to a two-dimensional classical wall jet. The waves at the wall had a pseudo-periodic behavior and their characteristics were studied statistically. (Author's abstract)
W83-03003

CONTEMPORARY STOCHASTIC APPROACH TO WATER RESOURCE SYSTEMS: THE ARMP AND FEATURE PREDICTION MODELS,
State Univ. of New York at Buffalo. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2A.
W83-03060

PROOFS OF THE VOLUME AVERAGING THEOREMS FOR MULTIPHASE FLOW,
Purdue Univ., Lafayette, IN. Dept. of Agronomy.
J. H. Cushman.
Advances in Water Resources, Vol 5, No 4, p 248-253, 1982. 13 Ref.

Descriptors: *Mathematical equations, *Multiphase flow, Flow, Hydraulics, Fluid mechanics.

Formal rigorous proofs are presented for the volume averaging theorems of multiphase flow. The proofs are the first that are conceptually elementary and yet mathematically rigorous. The proofs as presented hold for a n-dimensional system and may be generalized to hold for a differentiable manifold. The motivation for presenting distributional proofs of the volume averaging theorems was twofold: first, a particular function is on the microscopic scale and may experience jump discontinuities between phases. This implies that the differential equations governing the microscopic flows should be thought of as distributional where a distribution given by a locally integrable function is defined. Secondly, all prior proofs of these theorems have been somewhat heuristic and in some cases contain errors. The proofs as presented lay the sound mathematical base needed for a proper understanding of multiphase flow phenomena. (Baker-FRC)
W83-03063

8C. Hydraulic Machinery

DAM AND RIVER SAND-DRIFTING INSPECTION (LA BATHYMETRIE--TECHNIQUE DE SURVEILLANCE DE L'ENSABLEMENT DES FLEUVES ET DES RETENUES),
Travaux Sous-Marins, Peney (Switzerland).
For primary bibliographic entry see Field 2J.
W83-02961

DEVELOPMENT POTENTIAL FOR LOW-HEAD HYDRO,
Shawinigan Engineering Co. Ltd., Montreal (Quebec). Hydro-Electric Div.
R. Nair.
International Water Power and Dam Construction, Vol 34, No 12, p 49-56, 72, December, 1982. 8 Fig, 2 Tab, 13 Ref.

Descriptors: *Electrical equipment, *Hydroelectric power, *Turbines, Design criteria, Generators, Electric power production, Hydraulic machiner, Inverters.

Variable speed operation of hydraulic propeller turbines in a low head hydroelectric scheme has several advantages compared with constant speed turbines. It allows greater flexibility in equipment design and application to a wide variety of site requirements. Water hammers caused by speed governing are eliminated. Self-commutated inverters, more expensive than line-commutated inverters, are well-suited to small hydro schemes because they have good inherent voltage regulation and the ability to handle wide variations in load magnitude, power factor, and frequency. They have high efficiency and small size. Disadvantages of variable speed operation are the need to vary the number of units in service to obtain constant flow and low efficiency at partial loads. Inertia requirements and the speed governor may be eliminated in many variable speed units. Kaplan control is often not needed in bulb units. (Cassar-FRC)
W83-03005

SMALL PUMP-TURBINES TO SUPPLEMENT GRID CAPACITY,
McGraw-Edison Co., Mountainside, NJ.
L. Schafer.
International Water Power and Dam Construction, Vol 34, No 12, p 38-40, December, 1982. 2 Fig, 1 Tab.

Descriptors: *Turbines, *Electrical equipment, *Generators, Pump turbines, Hydraulic machinery, Hydroelectric power.

For most small hydropower applications an induction generator is more suitable than a synchronous generator. Induction generators are simpler to operate and are less expensive to operate at smaller sizes (below 1250 kW). They also need less switchgear equipment. However, synchronous generators are more suitable for isolated operation. They have higher efficiencies and can contribute to the maintenance of system voltage and power factor. (Cassar-FRC)
W83-03006

INSTALLED AND PLANNED MINI HYDRO,
Kossler G.m.b.H., St. Polten-St. Georgen (Austria).
E. Kossler.
International Water Power and Dam Construction, Vol 34, No 12, p 35-38, December, 1982. 8 Fig.

Descriptors: *Turbines, *Hydroelectric plants, Hydraulic machinery, Hydraulic structures.

Several small hydro plants built in small European communities are described. At Balavaus, Switzerland, pressure in the drinking water conduit has

been converted to more than 20 million kWh since the plant's commissioning 10 years ago. The Kropfitsch, Austria, plant, relocated in 1980, uses a double-jet impulse turbine. A four-jet impulse turbine was installed in 1977 during modernization of the Graubunden, Switzerland, plant. Output of the Stalvedro plant at Bivio, Switzerland, was tripled by replacing a large Francis spiral turbine (200 kW) with two compact turbogenerators (500 kW each). The Manegg station, Zurich, Switzerland, was updated without changing the existing buildings by using two existing turbine intakes and the tailwater chamber for two new vertical Kaplan tube turbines. Increasing demand at Taubinger's private power station led to addition of a new plant featuring an S-tube turbine, which operates a high efficiency even at small discharges. In Bamberg, Germany, an underground power station and a 2500 kW heat pump are being built so that the modern construction does not detract from the historical mill quarters being restored. (Cassar-FRC)
W83-03007

ENERGY FOR RURAL DEVELOPMENT,
Intermediate Technology Industrial Services, Rugby (England).
R. Holland.
International Water Power and Dam Construction, Vol 34, No 12, p 29-32, December, 1982. 4 Fig.

Descriptors: *Hydroelectric plants, *Developing countries, *Turbines, Hydraulic machinery, Rural areas, Dormilon River, Columbia, Sri Lanka, Control systems, Water wheels, Powerplants, Electric power production, Pelton wheels.

Micro hydropower is a more effective choice for rural electrification than grid extension, especially in developing countries. A guaranteed industrial user for the power produced by a system helps ensure the success of a micro hydro project. Electronic load control has also been an integral part of several projects. A sawmill was built in connection with the hydroelectric system built on the Dormilon River, Columbia. River water is diverted to a 6 kW four-jet direct drive Pelton wheel governed by the electronic load control to accept whatever flow is available (design flow, 55 liters per sec). In Sri Lanka hundreds of private micro hydro plants on tea estates have fallen into disuse. Two renovation projects are described in which Francis turbine-generator sets in poor condition are being replaced with vertical axis four-jet Pelton wheels. Power produced by these plants is expected to supply complete power requirements for the tea processing machines in the wetter months. (Cassar-FRC)
W83-03008

8D. Soil Mechanics

SAFETY FACTORS FOR PROBABILISTIC SLOPE DESIGN,
Worcester Polytechnic Inst., MA.
R. A. D'Andrea, and D. A. Sangrey.
Journal of the Geotechnical Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 108, No 9, p 1101-1118, September, 1982. 7 Fig, 7 Tab, 42 Ref.

Descriptors: *Slope stability, *Slope protection, Model studies, *Safety, *Sensitivity analysis, *Design criteria, Slopes, Soil Conservation, Slope degradation, Slope stabilization, Statistical analysis, Mathematical studies, Probabilistic process.

Some inconsistencies in the present methodology for solving slope stability problems under undrained conditions are noted. To handle these differences, a first-order, second-moment model based on probability is suggested for safe slope design. The technique incorporates these problems as separate variables and uses partial safety factors that are proportional to the coefficient of variation of the pertinent parameters. A circular arc failure mechanism is assumed, and the adequacy of the design is based on the derived value of a reliability measure, the safety index. This index reflects the probability of occurrence of the assumed failure mechanism. Statistical data for the required load, resistance factors, and stochastic bias factors that contribute to resistance are given. This information may be used to calculate the safety index associated with current design techniques. Sensitivity studies to determine which variables have the greatest effect on design are also presented. Partial safety factors are proposed for designs corresponding to a desired failure probability. (Geiger-FRC)
W83-03090

8E. Rock Mechanics and Geology

PRECAUTION MEASURES AGAINST UPLIFT AND SEEPAGE EFFECTS ON GIGERWALD ARCH-DAM (MESURES DE PROTECTION CONTRE LES EFFECTS DE LA SOUS-PRESSION ET DES INFILTRATIONS AU BARRAGE-VOUTE DE GIGERWALD),
Bureau d'Ingenieurs-Conseils, Lausanne (Switzerland).
E. Schnitzler.
Wasser, Energie, Luft, Vol 73, No 4, p 65-70, April, 1981. 9 Fig, 1 Tab, 1 Ref. English Summary.

Descriptors: *Arch dams, *Dam construction, *Uplift pressure, Dam foundations, Dam stability, Controlled drainage, Seepage control, Stress, Geologic fractures, Rock mechanics, Gigerwald Dam, *Switzerland.

The arch-dam at Gigerwald, Switzerland, which is 147 meters high, rests on partially fissured rock on its left bank. A variety of measures have been employed to reduce the negative effects of uplift pressure and seepage at the dam. These measures include deepening of the foundation to achieve better embedding in the rock; stability checking of the rocky abutment under more severe conditions; observation of the rock movements during construction; drilling of drainage boreholes in order to reduce the effects of uplift pressure and seepage; and use of proper observations of stress and discharge of seepage to check the efficiency of the precautionary measures. The drainage arrangement dimished the uplift pressure on the foundation, which apparently halted the spread of fissuration in one of the planes of fissuration. (Carroll-FRC)
W83-02960

8F. Concrete

LOSSES OF WATER AND UNDERPRESSURES AT THE DIXENCE DAM (PERTES D'EAU ET SOUS-PRESSIONS AU BARRAGE DE LA GRANDE DIXENCE),
Grande Dixence Societe Anonyme, Sion (Switzerland).
J. Torrione.
Wasser, Energie, Luft, Vol 73, No 4, p 78-82, April, 1981. 7 Fig, 2 Tab. English summary.

Descriptors: Dams, *Water pressure, *Water loss, Leakage, Dam foundations, Artificial lakes, Grand Dixence, *Switzerland.

The lake created by the dam at Grande Dixence, Switzerland, was first filled in the autumn of 1966. Leakages from the lake during this first filling were particularly concentrated on the left shore. Two series of injections of cement were used to reduce the leakage from 27 to 8 liters per second. The first series involved injection of 80 tons of cement into borings 15 meters long. The second series involved injection of 30 tons of cement into borings 17 and 60 meters long. Of the 16 devices used to measure the pressure at the level of the dam foundations, only three are still functioning. The highest pressure coefficient at the foundations now varies around 40%. Twenty manometers are used to measure the pressure of the percolating water in the galleries and pits. The pressures there are very high, sometimes reaching 100%, which is normal, since the measurements are made upstream from the dam and veil. However, the run-offs are insignificant. (Carroll-FRC)
W83-02962

8G. Materials

RIVER AND WATERCOURSE CROSSINGS AND LAKE OUTLETS WITH HDPE PIPES (FLUSS- UND GEWASSERKREUZUNGEN SOWIE SEEAUSLAUFLEITUNGEN MIT ROHREN AUS HDPE),
Europlast Rohrwerk G.m.b.H., Oberhausen (Germany, F.R.). Technische Beratung und Projektierung.
H. Bromstrup, and T. Schramm.
Wasser, Energie, Luft, Vol 73, No 1/2, p 1-5, January/February, 1981. 8 Fig, 5 Ref. (No English Summary).

Descriptors: *Pipes, *Construction materials, *Plastics, *Outlets, *Water conveyance, Underwater pipes, Conveyance structures, Hard polyethylene, Construction methods, Pipe manufacture, Pipe construction, Water pressure, Water transport, Conduits.

The use of hard polyethylene (HDPE) in the construction of pipes for conduits running under waterways and for outlets into lakes or oceans is discussed, and the manufacture and laying of such pipes is described. HDPE pipes can be manufactured in seamless extruded fixed lengths, obviating the need for welding joints at the laying site; they are light and easy to handle; their flexibility makes laying easier -- they usually conform to the shape of the river bed; they are resistant to corrosion and aging; and they are chemically stable, so are not affected by substances found for example in wastewaters. Underwater conduits can be either pressure pipes (used to carry drinking, cooling, or wastewater) or nonpressure pipes (for cables); wall thickness for the former is determined by interior pressure or by the load exerted outside and for nonpressure pipes by external load alone. Equations are given to calculate buckling pressure for an undistorted pipe lying on the river bed and for a distorted pipe embedded in the river floor, as well as for the safety factor against buckling. Pipes with a diameter of up to 160 mm can be wound onto drums and transported by truck; longer and larger pipes are carried by rail or water. Uplift during pipe laying is counteracted by ballast. Three laying methods are described: dragging the pipe through a dredged channel by a pulley on the bank; positioning the pipe above its destination and sinking it, using weights; and unwinding it from a boat into an underwater tunnel. (Gish-FRC)
W83-02803

CHANNEL DESIGN TO MINIMIZE LINING MATERIAL COSTS,
Agricultural Research Service, Kimberly, ID. Snake River Conservation Research Center.
T. J. Trout.
Journal of the Irrigation and Drainage Division, Proceedings of the American Society of Civil Engineers, Vol 108, No 4, p 242-249, December, 1982. 4 Fig.

Descriptors: *Linings, *Channel morphology, *Cost analysis, Open channels, Construction costs, Design criteria, Cross-sections.

A direct algebraic and graphical solution was developed to calculate the design of lined trapezoidal channels to minimize lining material costs when costs of bed and side linings are different. The method can also be used to calculate costs added as a result of deviating from optimal designs. Moderate deviations from optimal designs do not usually increase costs significantly. (Cassar-FRC)
W83-02837

CORROSION BEHAVIOR OF PASSIVATABLE STAINLESS STEEL UNDER REDUCING CONDITIONS WITH SIMULTANEOUS ABRASIVE STRESS (DAS KORROSIONSVERHALTEN PASSIVIERBARER NICHTROSTENDER STAHLE IN WASSERN UNTER REDUZIERENDEN BEDINGUNGEN BEI GLEICHZEITIGER ABRASIVER BEANSPRUCHUNG),
Mannesmann-Forschungsinstitut G.m.b.H., Duisburg (Germany, F.R.).
G. Herbsleb.

Gas- und Wasserfach: Wasser/Abwasser, Vol 123, No 7, p 343-355, July, 1982. 14 Fig, 2 Tab, 25 Ref.

Descriptors: *Corrosion control, *Pipes, Oxidation, Chemical reactions, Stainless steel, Oxidation-reduction potential.

Corrosion resistant properties of 18-10 chromium-nickel stainless steel have been investigated. These studies show that this steel maintains its corrosion resistant properties in aqueous sodium chloride solutions (35 to 35,000 ppm chloride) at potentials more negative than the pitting potential even when the following conditions are present: cathodic polarization (U(H)=-0.2 V); acidification to a pH of 3.9; the presence of chemical compounds which stimulate pitting, such as sodium sulfide bubbling with hydrogen sulfide; increased temperature up to 80C; abrasion; and flow rates up to 0.27 meters per second. The oxidizing capacity of water was found to be sufficently high to maintain the passive state at potentials more negative than the pitting even when these detrimental factors were present. (Author's abstract)
W83-03047

9. MANPOWER, GRANTS AND FACILITIES

9C. Research Facilities

FUNDING WATER POLLUTION RESEARCH,
Texas Univ. at Austin. Dept. of Civil Engineering.
G. A. Rohlich.
Water Science and Technology, Vol 14, No 9-11, p 1239-1243, 1982. 3 Tab, 10 Ref.

Descriptors: *Water pollution control, *Economic aspects, Planning, Economic evaluation, Water quality, *Financing, Federal support.

Unprecedented activity has been noticed during the past decade resulting from public awareness and concern about the quality of the environment. Because pollution problems cut across categorically defined media boundaries, it is difficult to determine the total expenditures for water pollution research. A reasonable estimate can be made of the funding specifically allocated for water pollution research, but this estimate is somewhat less than the total research effort. The total national research expenditures increased from about $13.5 billion to $25.9 billion in each of the past two decades. Although the expenditures in 1979 were more than double those in 1970, in constant dollars virtually no growth occurred. The percentage contributed by the Federal government has decreased over the years. The National Science Foundation report divides the expenditures into three categories: basic research, applied research and development. Estimates for the annual outlays for water pollution control are tabulated for the years 1969 and 1979. As shown, there has been an 8-fold increase in the total annual costs for water pollution abatement expenditures. The EPA is the major federal agency conducting research in this area, and its responsibilities continue to increase as additional environmental legislation is enacted. Budget constraints at all government levels will require more reliance on funding from the private sector, particularly for the basic research. (Baker-FRC)
W83-02871

10. SCIENTIFIC AND TECHNICAL INFORMATION

10F. Preparation Of Reviews

SEDIMENT TRANSPORT IN ALLUVIAL CHANNELS: RATES FOR EROSION AND DEPOSITION OF COHESIVE SEDIMENTS LITERATURE REVIEW AND EXPERIMENTAL DESIGN,
Oklahoma State Univ., Stillwater. Dept. of Chemical Engineering.
For primary bibliographic entry see Field 2J.
W83-03032

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W83-03016	3C
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W83-03018	2E
W83-03019	6E
W83-03020	2F
W83-03021	2F
W83-03022	6E
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W83-03026	2G
W83-03027	2G
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W83-03044	5B
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W83-03117	2J
W83-03118	2J
W83-03119	2K
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W83-03126	5D
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W83-03128	5D
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